

**PROCRASTINATION: MISUSE OF SELF-REGULATORY RESOURCES MAY  
LEAD TO FATIGUE**

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# Procrastination: The Misuse of Self-Regulatory Resources May Lead to Fatigue

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## SUMMARY

The relationships between procrastination, self-regulation, and fatigue were assessed. Previous researchers have suggested that procrastination is positively related to fatigue (Gropel & Steel, 2008), and that the use of self-regulation results in higher levels of fatigue (Muraven, Tice, & Baumeister, 1998). In the present study, I proposed that self-regulation is the mechanism underlying the relationship between procrastination and fatigue. Undergraduate students (N=110) first completed an in-lab questionnaire, then completed 15 online questionnaires per week for three weeks. The online questionnaires assessed sleeping and waking habits, along with reports of state fatigue. Procrastination was assessed through the time spent putting off getting out of bed each morning. Participants were split into two groups, and the experimental group was instructed to use an alarm clock without a snooze button during Week 2. Three findings were of interest. First, in contrast to global, self-reported behavior, aggregated measures of daily self-reported procrastination indicated a positive relationship with trait measures of procrastination, suggesting that global self-reports of behavior delay should be interpreted with caution. Second, trait procrastination was found to be a significant predictor of the amount of time spent delaying getting out of bed in the morning; however, the amount of time spent delaying getting out of bed in the morning was not predictive of subjective morning or afternoon fatigue. Finally, partial support was provided for a relationship between trait procrastination and state fatigue after accounting for other variables which have been shown to predict state subjective fatigue (e.g., neuroticism and anxiety; Ackerman, Kanfer, & Wolman, 2008). Based on these findings, I suggest that a stronger relationship exists between procrastination and fatigue at the trait



level than the state level, and the state-level relationship may operate through a mechanism other than self-regulation.

# CHAPTER 1

## INTRODUCTION

Procrastination has recently been defined as the voluntary “delay [of] an intended course of action despite expecting to be worse off for the delay” (Steel, 2007, p. 66). Approximately 20% of adults report chronic procrastination in everyday tasks (Harriott & Ferrari, 1996) and almost 50% report that procrastination is problematic (Solomon & Rothblum, 1984). For example, a survey of 100 adults indicated that 29% were currently putting off doing their taxes and 42% were currently delaying saving money for the future (Kasper, 2004). Tax firms such as H&R Block estimate that Americans overpay their taxes by approximately \$400 each year (Coolidge, 2004), perhaps due in part to delaying tax preparation. Taken together, these reports suggest that delaying an intended course of action can be costly.

Financial trouble represents one sphere in which procrastination leads to serious consequences. Sirois (2004) also explored the relationship between self-reported procrastination and preventative health behaviors among 182 Canadian students. Procrastination was negatively associated with consideration of future consequences ( $r = -.43, p < .01$ ), health-specific self-efficacy ( $r = -.37, p < .05$ ), and health behavior intentions ( $r = -.21, p < .01$ ). Lay and Brokenshire (1997) found that job search behaviors, such as sending out a resume or searching the classified want ads, were also negatively related to self-reported procrastination ( $r = -.22, p < .05$ ). Procrastination has also been associated with depression ( $r = .44, p < .01$ ; Solomon & Rothblum, 1984), stress ( $r = .25, p < .01$ ; Chu & Choi, 2005), anxiety ( $r = .13, p < .05$ ; Solomon & Rothblum, 1984), and neuroticism ( $r = .42, p < .01$ ; Milgram & Tenne, 2000).

Research on procrastination has burgeoned within the last 30 years, addressing potential antecedents and correlates to explore possible interventions that may aid in decreasing the tendency to procrastinate. One area in which research has yet to focus is the relationship between procrastination and fatigue. Fatigue has been defined as a sense of tiredness that results from both physical and emotional energy (Brown & Schutte, 2006; Zijlstra & Sonnentag, 2006) expended for a variety of reasons, such as work demands (Rook & Zijlstra, 2006). In a recent mega-trial of 9351 participants, Gröpel and Steel (2008) found that lack of energy predicted a significant portion of variance in procrastination ( $\Delta R^2 = .28, p < .01$ ). These results are consistent with prior findings from a study by Strongman and Burt (2000) of fifteen college students who kept diaries for six weeks and reported tiredness as one of the leading reasons for procrastination. In the mega-trial, lack of energy was assessed with two items: “I often feel lacking in enthusiasm” and “I usually lack energy” ( $\alpha = .84$ ). These items do not offer insight into whether lack of energy includes physical and/or mental energy, whether it is endorsed as a general or task-specific reason, or the mechanisms through which procrastination may be related to fatigue.

In what follows, I will describe the process of self-regulation as a plausible mechanism through which procrastination and fatigue may be related. In the first section, I discuss the history of procrastination research, including potential problems with common methodologies and a way in which to address them. In the second, third, and fourth sections, I will focus on self-regulation. In the second section, I discuss self-regulation as it has been related to procrastination, and I will offer a new way in which to consider the self-regulation process in the context of dilatory behavior. Automatic versus

controlled processing will be discussed. I will briefly draw an important distinction between self-regulation and self-control in the third section. In the fourth section, the limited resource model of self-regulation will be presented, and will be linked with fatigue in the fifth section. In the sixth section, I explore an analogy between self-regulation and a muscle. Finally, in the seventh section, I describe the present research study which serves as a first step in illuminating the association between procrastination, self-regulation, and fatigue. The remaining sections are devoted to the procedural steps, statistical analyses, results and conclusions drawn from the current study.

### *Procrastination*

Given the relative nascence of procrastination research, an overarching theory of procrastination does not yet exist, and numerous measurement strategies have been employed to assess the tendency to delay. Procrastination has been measured extensively through self-report measures which have been mainly designed to assess academic or everyday procrastination (see Ferrari, Johnson, & McCown, 1995 for a description of the most widely-used measures). However, several issues accompany self-report measures, including the assumptions that participants may accurately access their attitudes regarding the items presented, that the response scales adequately capture the responses of participants, and that the participants are willing to report honestly (Mischel, 1977).

In light of the various problems presented by self-report assessments, researchers have developed behavioral measures of procrastination to use in conjunction with self-report measures. Solomon and his colleagues assessed procrastination in terms of time, including for example, the amount of time it took students to sign up for experiments (Solomon & Rothblum, 1984) and how long it took students to begin self-paced quizzes

(Rothblum, Solomon, & Murakami, 1986). A few researchers have assessed procrastination as a difference score between predicted and actual time for tasks. Pychyl, Morin, and Salmon (2000), for example, assessed procrastination as the difference between students' predicted study time and actual study time. Buehler, Griffin, and Ross (1994) operationalized procrastination in terms of the difference between predicted and actual thesis defense dates. Some studies have assessed procrastination with observer ratings, such as teacher ratings of student procrastination (Owens & Newbegin, 1997, 2000).

Combining self-report measures with behavioral measures is likely to offer a more complete and accurate representation of procrastination (Rushton, Brainerd, & Pressley, 1983). To date, however, research on this topic has largely explored differences between individuals in a cross-sectional manner. As a result, the relationship between one self-report measure and one behavioral measure is typically assessed. According to Rushton et al. (1983), "the sum of a set of multiple measurements is a more stable and unbiased estimator than any single measurement from the set" (pp. 18-19). In the same way that self-report measures consist of several items pertaining to procrastination, multiple measures of the behavior should also be obtained (i.e., several measures of the same behavior or a measure of several similar behaviors). This measurement strategy describes the principle of aggregation, through which within-subjects, repeated-measures methods are suggested when possible. Accordingly, self-report measures should be related to an aggregated behavioral measure in order for measurement errors to average out and a clearer, more accurate relationship to emerge.

Aggregation would also attenuate the interaction of person and situation variables described by Mischel (1977). Because “much human behavior depends delicately on environmental considerations” (p. 250), cross-sectional measurements may reflect a combination of the variable of interest and the current influence of situational factors, which may not be of interest. These situational influences represent measurement error when assessing traits, either systematic, random, or both. Assessments of the variable over a period of time would allow the contextual influences, or error, to even out, presenting a more consistent measurement of the particular trait variable.

The experience-sampling method (ESM; Miner, Glomb, & Hulin, 2005), also referred to as daily diary studies or ecological momentary assessments, has become a popular method for assessment in many fields due to its numerous advantages (e.g., Kimhy et al., 2006; Le, Choi, & Beal, 2006). This method captures participants’ episodic psychological processes over the course of the day, providing richer, more detailed information than retrospective questionnaires are able to capture (Christensen, Barrett, Bliss-Moreau, Lebo, & Kaschub, 2003). ESM appears to be a useful tool for measuring state variables that are likely to fluctuate in short periods of time, as opposed to trait variables, which are defined as relatively stable over long periods of time. A considerable amount of within-subject data may be collected and aggregated through this method, which, as discussed above, provides a more robust measure of the variable(s), giving greater power to detect smaller effects. As within-subjects designs are not frequently used in the procrastination literature, this method might contribute to the present understanding of individuals’ tendency to delay.

In addition, ESM reduces the amount of possible recall bias that may distort participants' answers. As Feldman Barrett and Barrett (2001) described, "recalling information is a reconstructive process influenced by a multitude of factors" (p. 175). ESM allows participants to report experiences, behaviors, thoughts, and feelings as they happen rather than attempting to reconstruct them after a period of time. Responses are often time-stamped to give researchers an accurate record of the time at which the participants complete questionnaires to ensure that participants are not relying on retrospection. When asked, participants report that ESM captures their true experiences better than other, more static methods (Miner et al., 2005). Taken together, these advantages may facilitate higher external validity than what might be obtained through retrospective self-report or behavioral methods.

Only one study has been conducted that utilized ESM to assess procrastination. Pychyl, Lee, Thibodeau, and Blunt (2000) explored the affective correlates of procrastination among forty-five undergraduate students. Participants were paged eight times a day, for five days preceding an important academic deadline (e.g., exam, project, or paper). When signaled, participants immediately completed questionnaires pertaining to the task in which they were currently engaged, the extent to which they currently felt that they were procrastinating, feelings towards tasks currently being put off, if any, and current affective states. Upon completion of the five-day period, participants completed two measures of general procrastination. Of the 1800 pager signals, participants responded to a total of 1465 of them and reported procrastinating 537 times (36.2%). Activities in which participants were engaged were rated as more pleasant ( $t(42) = 7.77$ ,  $p < .01$ ), less confusing ( $t(40) = -7.06$ ,  $p < .01$ ), less difficult ( $t(41) = -9.45$ ,  $p < .01$ ), less

important ( $t(42) = -10.54, p < .01$ ), and less stressful ( $t(42) = -9.95, p < .01$ ) than the activities that were being delayed. However, 36.2% represents a relatively small proportion of time-points during which participants were procrastinating, and the outcomes resulting from task delay were not assessed. Interestingly, the relationships between current procrastination and both positive and negative affective state were not significant, suggesting that state tendencies to procrastinate were not related to participants' state affect. However, general procrastination was associated with general negative affect ( $r = .35, p < .05$ ). Nonetheless, this experience-sampling study presents a constructive foundation for the use of ESM in the assessment of procrastination. Future studies may build on this initial step by taking further advantage of ESM.

In summary, procrastination has become a focus of psychological research within the last thirty years. Greater emphasis should be placed on the methodology used to assess the antecedents, correlates, and underlying mechanisms of procrastination in order to advance the current knowledge towards a theory of procrastination. One approach that may be particularly advantageous in further exploring the ways in which procrastination operates may be to follow the suggestion of Rushton et al. (1983) and aggregate measures taken over a period of time through ESM.

### *Self-Regulation*

Self-regulation is part of the executive function, which controls primarily private cognitions related to actions and goals of the self (Barkley, 1997; Baumeister, 2000). Self-regulation plays an integral role in the framework of goal-setting theory, recently described as one of the three most important approaches to work motivation to emerge over the last thirty years (Latham & Pinder, 2005). According to this theory, goal setting



involves a conscious process of goal commitment and the assessment of goal progress through a feedback loop (Locke & Latham, 2002). This loop allows the individual to assess behavior relevant to a particular goal and, if there is a misalignment, either adjust behavior or adjust the goal. The process of assessment and adjustment is also known as self-regulation, which is best defined as “the processes by which an individual alters or maintains his[her] behavioral chain in the absence of immediate external supports” (F. Kanfer & Karoly, 1972, p. 406). The distinction between external (alpha) and internal (beta) regulation is important in that external “supports” or factors may also influence behavior, as suggested by Mischel (1977). Self-regulation, however, refers to an internal process of goal-behavior alignment without external motives or influences.

Recently, Steel (2007) published a meta-analysis of the procrastination literature entitled “The Nature of Procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure.” As the title of this article suggests, Steel claims that procrastination may represent an individual’s failure to regulate behavior in order to meet a goal. However, two problems arise from this meta-analysis. First, the ways in which procrastination may represent a self-regulatory failure are not explored, nor did the author present a detailed account of the ways in which a self-regulation “failure” may occur. A failure may occur in several ways, such as a complete lack of self-regulatory process activation, a breakdown in the self-regulatory process, or the interference of another process. Consequently, a lack of an explanation may lead readers to believe that self-regulation is absent when procrastination occurs. Second, procrastination was defined through conscientiousness. Steel supported this view with meta-analytic evidence suggesting that procrastination represents low conscientiousness through

distractibility, poor organization, low achievement motivation, and a gap between intentions and actions. However, defining procrastination through conscientiousness does not present a complete picture of procrastination. While procrastination does include an element of failure to work towards an originally intended goal, which is one component of conscientiousness, the tendency to delay also includes elements that are not encompassed by conscientiousness.

For example, procrastination does correlate with the six facets of conscientiousness designated by Costa and McCrae in their Five-Factor Model of personality (e.g., Costa, McCrae, & Dye, 1991), which include competence, order, dutifulness, achievement-striving, self-discipline, and deliberation ( $r = -.31$  to  $-.75$ , Johnson & Bloom, 1995; Lay, 1997; Schouwenburg & Lay, 1995). But procrastination is also related to other variables, such as boredom proneness ( $r = .49$ ,  $p < .01$ ; Blunt & Pychyl, 1998) and self-efficacy ( $r = -.29$ ,  $p < .01$ ; Wolters, 2003), which do not fit with the facets of conscientiousness listed above. While other researchers have reported strong negative correlations between procrastination and conscientiousness (e.g.,  $r = -.61$ ,  $p < .01$ ; C. H. Lay & Brokenshire, 1997), given that the correlations are not equal to one or negative one after correcting for unreliability of the measures, placing procrastination and conscientiousness at two ends of a unidimensional scale does not offer a fully accurate portrayal of procrastination.

Moreover, empirical evidence for a relationship between self-regulation and procrastination has been offered (Senecal, Koestner, & Vallerand, 1995), suggesting that procrastination does not represent a complete lack of self-regulatory processes as Steel (2007) may have implied. In this study of 498 undergraduate French-Canadian students,

self-regulation variables accounted for 25% of the variance in academic procrastination. Self-regulation variables included intrinsic motivation to know, external regulation, identified motivation, and amotivation. These variables were associated with a 10-item self-report measure of procrastination at  $r = -.28, p < .01$ ,  $r = -.03$ , n.s.,  $r = .17, p < .01$ , and  $r = .26, p < .01$ , respectively. Though these correlations are relatively small, these findings indicate that, contrary to Steel's (2007) claim of procrastination as a failure or absence of the self-regulatory system, self-regulation is related to procrastination at the trait level.

As a result, investigators have explored the ways in which self-regulation may be implicated during procrastination. Baumeister (1997), for example, defined a self-regulation failure as "a self-defeat that occurs when people's normal systems for regulating and controlling their own behavior break down in systematic, standard ways" (p. 145). In this theoretical article, he discussed two ways in which self-regulation failure may occur: underregulation and misregulation. Underregulation includes a failure to adjust one's behavior or goals such that they align, suggesting a lack of thought or planning dedicated towards outlining a strategy through which to reach one's goals. For example, a student may set a goal to get an A on a test, but she may neglect to outline a way in which to do so, which might include studying or attending review sessions. Misregulation, on the other hand, involves concerted efforts to align behavior and goals that do not result in goal attainment, suggesting that strategies were devised to assist in reaching one's goals, but were not sufficiently helpful. For example, the student with the goal of getting an A on a test may have devised detailed plans regarding the time and material she will spend studying, but encounter difficulty in trying to implement those plans. Given that procrastinators generally have the same intentions to study as

nonprocrastinators, but fail when acting upon those intentions (Buehler et al., 1994; Pychyl, Morin et al., 2000; Steel, 2007), planning and strategizing methods through which to reach a goal do not seem to be the areas in which procrastinators have trouble. Rather, it appears that procrastinators lack the skills necessary for devising *adequate* plans to reach a goal and/or acting upon those plans. Procrastination, then, may not represent a failure to use the self-regulatory system all together, but rather a failure for self-regulatory efforts to result in the originally desired performance goals.

From a neuropsychological perspective, “if an action is under the control of a goal list, it should continue until the goal is satisfied; and that the failure of this process should trigger the search for another, more appropriate action structure” (Jeannerod, 1997, p. 162). In other words, once a goal-directed action has been decided upon, it should be pursued until the goal is met. However, should a failure arise either in implementing the action or in the ability of the action to produce the desired goal, a more appropriate action and/or goal will be sought. This view suggests that failure to reach an originally intended goal due to procrastination would prompt the setting of a more feasible goal, which would require self-regulatory processes.

This description also conveys that procrastination is a process that relies on controlled thoughts. Controlled processes require an individual’s attention and are intentional and flexible, whereas automatic processes, in contrast, are activated unintentionally often by environmental cues and do not require a conscious effort (Devine, 1989). Self-regulation calls upon controlled processes in order to actively set goals and consciously devise plans through which to reach them (F Kanfer & Stevenson, 1985). It appears, then, that procrastination includes controlled thoughts of self-

regulation that are put towards goal-attainment strategies that the individual does not carry through.

### *Self-Regulation vs. Self-Control*

An important distinction should be drawn between self-regulation and self-control. Many authors use the terms interchangeably (e.g., Baumeister, 2000; Muraven et al., 1998; Steel, 2007), but closer examination suggests that the terms represent similar but distinct concepts. McCullough and Willoughby (2009) also offer insight into the distinction between the two in a theoretical article regarding the importance of both self-regulation and self-control in many life domains, religion in particular. According to the authors, self-regulation involves guiding or adjusting behavior in pursuit of a desired goal. Though the process may not be a cognitively-controlled process in all instances, self-regulation is likely a deliberate thought when exerted over tasks that involve executive functioning, such as planning or goal striving.

F. H. Kanfer (1977) suggested that while self-regulation implicates the internal processes relative to goal-behavior alignment, self-control includes exertion of self-regulation in the context of various external influences. Consequently, self-control represents a specific type of self-regulation, whereby the individual refrains from a particularly attractive action that may be available in a given context in order to pursue a goal that has greater perceived long-term gains. Generally speaking, self-control is exerted in order to refrain from a particular behavior (e.g., resisting certain food cravings when on a diet), whereas self-regulation is exerted to produce a goal-related behavior (e.g., making oneself study for an upcoming exam). Both require regulation of thoughts and behavior, but do so by either prompting or inhibiting behavior. Self-control may rely

on the same resources necessary for self-regulation, as there is a clear overlap between the two processes. Baumeister (1997) referred to self-control as the more colloquial term. For present purposes, the terms self-regulation and self-control will be used in keeping with the distinction provided by McCullough and Willoughby (2009). However, in discussing the work of other authors, the terms will be used as those authors chose to use them.

#### *Limited-Resource Model of Self-Regulation*

The majority of research on self-regulation focuses on a limited-resource model. Muraven and Baumeister (2000) suggested that self-control is a limited resource which may be depleted, much like a muscle's ability to do work. In this theoretical article, self-control was defined as "the exertion of control over the self by the self" (p. 247) and occurs when the person chooses to override various urges, behaviors, desires, or emotions. Only a certain number of processes may be controlled at a given time, and once self-control has been exerted, fewer resources exist shortly thereafter to dedicate towards other self-control processes. Taken together, these restrictions suggest that a limited pool of resources may be dedicated towards self-control efforts. A similar model may be applied to self-regulation, whereby an individual has a goal, monitors behavior towards the goal, wishes to align behavior with reaching the goal, and adjusts behavior or the goal as necessary (Carver & Scheier, 1998). Such a process requires conscious cognitive effort that depletes resources for further use within the short-term.

Empirical evidence has been provided for the limited-resource model of self-regulation through three studies conducted in the laboratory (Muraven et al., 1998). Based on the assumption that engaging in self-regulation would deplete resources for

future tasks that might require those resources, individuals were asked to complete consecutive tasks that require self-regulation. For example, three groups were compared on the duration of time they squeezed a handgrip, which the authors claimed is a well-established measure of self-regulatory ability rather than physical strength, both before and after an affect-regulation task. One group of participants was asked to overtly express the emotions they felt while watching a sad movie, while the second group was asked to suppress their emotions. These two affect-regulation groups were compared to a control group, which was given no instruction regarding mood expression. Participants were asked to squeeze the handgrip before and after watching the movie. Participants in the combined affect-regulation groups reported that the instructions required more effort to follow than participants in the control group ( $t(37) = 3.59, p < .01$ ). Furthermore, those who were instructed to regulate their emotional expression showed greater decline in handgrip duration time compared to those who were given no instructions regarding emotion regulation ( $t(38) = 1.98, p < .05$  for suppression group and  $t(38) = 2.32, p < .05$  for the over-expression group).

Participants were also asked to report their fatigue at the beginning of the study, after watching the movie, and upon completion of the study. Those who were instructed to regulate their emotional expression reported a greater increase in fatigue from before to after the movie than those in the no instruction group ( $F(1,57) = 3.84, p < .05$ ). These findings suggest that exerting self-regulatory efforts is more fatiguing than not exercising self-regulation. This study was replicated with several different methods (e.g., thought suppression and unsolvable anagrams) to ensure that the results were not due solely to the ways in which self-regulation was operationalized (i.e., emotion regulation and squeezing

a handgrip). Similar results were reported, suggesting that self-regulatory effort exertion leads to depletion of self-regulatory resources and increased reported fatigue.

### *Fatigue*

Fatigue may be considered a warning signal for the over-commitment of resources towards a given task (Dinges, 1995; Hockey, Maule, Clough, & Bdzola, 2000). Individuals in the working population frequently complain of fatigue, with incidence rates between 22% in the Netherlands and 38% in the UK (Rook & Zijlstra, 2006). Many terms have been used to describe this phenomenon, such as sleepiness (Akerstedt, Fredlund, Gillberg, & Jansson, 2002b; Dinges, 1995), mental fatigue (Hockey & Earle, 2006; Webster, Richter, & Kruglanski, 1996), and subjective fatigue (Brown & Schutte, 2006). In keeping with Brown and Schutte's (2006) conceptualization of subjective fatigue, in which fatigue is a "pervasive sense of tiredness or lack of energy that is not related exclusively to exertion (p. 585), subjective fatigue will be used to refer to reported overall fatigue, which includes both mental and perceived physical fatigue.

Similar to the limited resource model of self-regulation (Carver & Scheier, 1998; Muraven & Baumeister, 2000), a compensatory control model of fatigue has been proposed (Hockey & Earle, 2006). In this model, individuals compare current behaviors to a target goal. If the behavior and goal do not align, the individual either increases effort or reduces the goal, each with different fatigue outcomes. Hockey and Earle (2006) suggested that the resources necessary to maintain relative equilibrium between behaviors and goals draw upon the resources of the executive control system, similar to the self-regulatory system.



Support of the compensatory control model was offered by Webster et al. (1996), who reported that fatigue was related to the motivational state of need for closure due to depleted resources for cognitive processing. A total of 88 undergraduate students participated in an experiment in which fatigue was manipulated via assessment before class, after class, or after a two-hour exam. Greater fatigue was reported after the exam ( $F(1,84)=72.60, p<.01$ ) than before or after a regular class period, and quicker impressions were formed with very little effort or thought after the exam ( $F(1,86)=3.89, p<.05$ ). The authors concluded that fatigue serves to decrease cognitive capacity, which increases one's need for closure and decreases the time it takes to form an impression. These findings provide support for both the compensatory-control model and previously reported findings that resource depletion leads to fatigue.

#### *Self-Regulation as a "Muscle"*

The resource depletion model of self-regulation portrays self-regulatory resources as similar to those of a muscle, whereby repeated use depletes strength in the short-term. Over a period of time, however, repeated use of the muscle may cause its strength to increase. If self-regulation does resemble a muscle, its strength ("self-regulatory strength"; Schmeichel & Baumeister, 2004) should increase after repeated use over time, either through increased resource capacity (power) or increased resistance to fatigue (stamina; Muraven, Baumeister, & Tice, 1999). However, research provides mixed support for this hypothesis. The research presented above by Muraven et al. (1998) only supports the first aspect of the analogy between self-regulation as a muscle in that self-regulation leads to a decline in self-regulatory resources available for tasks in the near future. After watching a 3-minute film clip, participants filled out a brief questionnaire

regarding their mood, and immediately engaged in the handgrip task. Though the authors do not explicitly offer the amount of time between these events, the time lapse between self-regulatory exercises was likely less than thirty minutes based on the procedural description. Similar to a muscle, then, repetitious use of self-regulatory resources causes a depletion of those resources in the short-term.

In order to address the second aspect of the analogy between self-regulation and a muscle, Muraven et al. (1999) conducted a longitudinal study of college students over a period of two weeks. All participants completed the handgrip task (described above) upon entering the study, followed by a thought suppression task and another handgrip measure. This process provided a baseline of both self-regulatory strength and depletion for each participant. Then, four groups were asked to perform behavioral, affective, and cognitive self-regulation exercises consistently over a two-week period, including maintaining good posture at all times, mood-regulation through diary entries, and keeping two food diaries, respectively. A fifth group was included as a control group that was not given any exercises to perform over the two-week period. At the end of two weeks, participants returned and performed the same sequence of handgrip, thought suppression, and handgrip tasks.

After the two-week period, performance on the handgrip task before thought suppression remained relatively stable (statistics not offered by the authors), suggesting that resources available for self-regulation did not increase after two weeks of self-regulatory exercises. However, relative to the control group, the decrease in performance on the handgrip task after thought suppression for the remaining groups was not as large after the two-week period ( $F(1,64) = 5.57, p < .05$ ), suggesting that self-regulatory

exercises may have improved participants' resistance to fatigue (stamina). However, the authors also report that the performance of the control group on the handgrip task after thought suppression decreased substantially from the original baseline measure. Ideally, the control group should perform in a relatively stable manner on the first and second assessments. Thus, the reported results may be attributable to changes in the control group, changes in the groups that performed regular self-regulatory tasks, or both. Taken together, these findings do not offer clear support for increased resources or resistance to fatigue after periods of repeated self-regulation.

In summary, self-regulation is a cognitive process and/or skill set involved in goal setting and goal-directed behavior. When procrastination occurs, self-regulatory processes are engaged in order to provide either a different strategy through which to attain the original goal or to revise the original goal. Self-regulation calls upon a limited resource such that repeated self-regulation depletes available resources and leads to fatigue in the short-term. Prolonged periods of self-regulation do not serve to increase self-regulatory capacity or resistance to fatigue. As a result, repeated procrastination over a short time-period may deplete self-regulatory resources through the increased use of self-regulation, which may lead to increased levels of fatigue.

### *The Present Study*

The present study explored an area in which procrastination frequently occurs but research has yet to focus: getting out of bed in the morning. A longitudinal approach was taken using ESM in order to obtain a more accurate assessment of individuals' waking tendencies, as suggested by Rushton et al. (1983) and Mischel (1977). In the present study, I also assessed both self-reported and behavioral procrastination.

Specifically, behavioral procrastination was assessed through the alignment of the time at which participants get out of bed with the original goal time for which an alarm clock is set. The existence and use of the “snooze” button suggests that many people delay getting out of bed at the originally intended time. If individuals do not get up at the originally intended time, a more appropriate waking time must be set. In the proposed study, the term “snooze time” refers to the time individuals spent delaying getting out of bed, a delay which is typically facilitated through the use of a snooze function on an alarm device. Based on research presented above, if individuals procrastinate getting out of bed in the morning, self-regulatory processes should be engaged in order to devise a new goal time at which to arise.

Self-regulation was assessed both indirectly, through the outcome variable of subjective fatigue measured upon waking and in the afternoon, and directly, through a self-report measure given at the end of the study. Because the many self-regulation studies assess fatigue shortly after self-regulatory exercises (e.g., Muraven et al., 1998), subjective fatigue was assessed upon waking. Fatigue assessments have not been obtained after several hours of self-regulation exercises in previous research. However, afternoon fatigue reports could detect potential residual associations of morning snooze time on reported fatigue throughout the day, and fatigue from other potentially resource depleting tasks. This assessment does not offer conclusive results regarding effects of snooze time on daily trends in fatigue, but it does provide a first step to determining whether snooze time is associated with subjective fatigue throughout the day. As a result, no a priori hypotheses were proposed for the afternoon assessment.

As discussed above, research has not provided support for increased resource capacity or resistance to fatigue resulting from repeated self-regulatory exercises over time. Accordingly, it was not expected that individuals who regularly delay getting out of bed differ from individuals who do not delay getting out of bed in their capacity for self-regulation or resistance to fatigue after self-regulatory processes that may be engaged due to snooze time. More simply, while individual self-regulatory differences may be present, based on research to date, they are not likely to be attributable to differences in capacity or fatigue resistance that result from repeated delay of getting out of bed over time. Therefore, individuals who regularly procrastinate getting out of bed were recruited.

The relationship between procrastination and self-regulation was explored by measuring the snooze time of individuals in two groups each morning for three weeks, and altering the snooze time for individuals in one group during one week. Individuals in the experimental group were asked to report their regular snooze time for a five-day period, then they were instructed to minimize snooze time for the next five-day period. Individuals were then allowed to return to their preferred waking process during the final five-day period. During this final week, it was expected that individuals would revert to snoozing after the alarm first rings in the morning. The control group reported regular snooze times each morning for all three weeks. Individuals in both groups reported the number of hours slept each night, as this factor is likely to be an additional contributor to subjective morning fatigue. The following set of predictions was explored. Hypotheses 2 and 3 refer to the experimental group alone, and all other hypotheses refer to the experimental and control groups combined.

*H1: Trait procrastination will be positively associated with snooze time during Weeks 1 and 3 (anticipated  $r = .55$ ,  $f^2 = .30$ ).*

*H2: After statistically controlling for the number of hours slept, snooze time will be positively associated to subjective morning fatigue (anticipated  $r = .50$ ,  $f^2 = .25$ ).*

*H3: After statistically controlling for the number of hours slept, subjective morning fatigue scores will be lower during Week 2 than during Week 1 (anticipated  $d = -.40$ ).*

*H4: After statistically controlling for the number of hours slept, subjective morning fatigue scores reported during Week 3 will be greater than subjective morning fatigue during Week 2 (anticipated  $d = .40$ ).*

In addition to exploring individuals' procrastination and self-regulation tendencies when working towards a goal, the current study also explored individuals' motivation orientation towards setting and approaching goals. Elliot and McGregor (2001) developed a 2x2 achievement goal framework that describes four types of goal orientations along two axes of mastery-performance and approach-avoidance. This framework was based on previous development of a mastery-performance dichotomy (e.g., Ames & Archer, 1988) and the more recent application of the approach-avoidance axis to performance orientation (e.g., Elliot & Church, 1997). Elliot and McGregor (2001) further delineated the relationship between these goal approaches by differentiating between approach and avoidance on one axis, and mastery and performance on the other. The resulting model consists of four quadrants which combine each orientation axis: mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance. In this framework, individuals with a mastery goal orientation focus on gaining the skills and understanding required by various tasks, whereas

individuals with a performance goal orientation focus on achieving a positive evaluation of their performance in relation to others. Individuals with an approach orientation are more likely to take on goals they find challenging with the hopes of achieving success, whereas those with an avoidance orientation are more likely to avoid tasks that might be challenging in order to avoid potential failure.

Little research has been conducted to explore the ways in which these goal orientations may be related to procrastination, and only trait procrastination has been explored thus far. Wolters (2003) explored the relationship of the trichotomous framework of mastery, performance-approach, and performance-avoidance orientation with academic procrastination in undergraduate students. Students with greater mastery orientation were less likely to procrastinate their academic work ( $r = -.32, p < .01$ ). Additionally, students with a greater tendency to procrastinate also reported greater performance-approach orientation ( $r = .29, p < .01$ ) and performance-avoidance orientation ( $r = .22, p < .01$ ). The present study explored the relationship between goal orientation and procrastination, expanding upon the work of Wolters (2003) by including all four quadrants of the 2x2 framework suggested by Elliot and McGregor (2001). However, a priori hypotheses were only proposed with respect to trait procrastination and the performance-mastery axis. Exploratory analyses examined the relationship between each orientation and snooze time during Weeks 1 and 3, as well as the time spent in bed awake before arising in Weeks 1 and 3. The following predictions were explored.

*H5: Trait procrastination will be negatively related to mastery orientation (anticipated  $r = -.28$ ).*

*H6: Trait procrastination will be positively related to performance orientation*  
(anticipated  $r = .27$ ).

*Other contributors to subjective fatigue*

Several measures were included to assess other variables that may potentially contribute to subjective fatigue. Fatigue upon waking may result from several factors aside from self-regulation, such as sleep disturbance or time-of-day preferences. Additionally, trait negative affect is associated with both procrastination and subjective fatigue and may contribute to morning fatigue scores. These three variables were assessed through self-report measures. Although these variables are likely to influence morning fatigue scores, it was not expected that they would affect the rank order of fatigue scores that may be reported over the three-week period.

*Sleep Disturbance.* Akerstedt and colleagues have conducted several studies which assess the relationship of sleep disturbance and fatigue. Akerstedt et al. (2004) reported that sleep disturbance predicted fatigue in 5720 employed adults in Sweden (odds ratio 4.31; 95% confidence interval 3.50-5.45). While it is not surprising that high levels of sleep disturbance are likely associated with high levels of fatigue, fatigue is also likely to fluctuate in accordance with other contributing factors. To assess the changes in fatigue that may be attributable to general sleep troubles, the first four items of the Karolinska Sleep Questionnaire (Akerstedt, Fredlund, Gillberg, & Jansson, 2002a; Akerstedt et al., 2004) were included as a measure of general sleep disturbance. The following set of predictions were assessed.

*H7: Sleep disturbance will be positively associated with trait fatigue* (anticipated  $r = .60$ ).



*H8: Sleep disturbance will be positively associated with subjective morning fatigue*  
(anticipated  $r$  = between .35 and .45,  $f^2$  = .16).

*Time-of-Day Preference.* Procrastination may be related to the circadian rhythm of an individual, which determines to a certain extent the best and/or worst time of day for social, emotional, and intellectual functioning. Hess, Sherman, and Goodman (2000) reported that academic procrastination among 107 undergraduate students was positively associated with “eveningness,” or the propensity to engage in tasks during the evening ( $r$  = .38,  $p < .01$ )<sup>1</sup>. Dinges (1995) also reported that fatigue may fluctuate naturally over the course of the day due to the processes underlying an individual’s circadian rhythm. This research is of particular interest, as it relates a biological factor to procrastination, a variable known thus far to only have cognitive, behavioral, and affective components. In addition, this line of research sheds light on subjective fatigue through the lens of circadian rhythm and individuals’ propensity for performing tasks at various times of day. The Morningness-Eveningness Questionnaire was included to assess whether reports of fatigue vary depending on time-of-day preference as a function of circadian rhythm. Higher scores on this questionnaire indicate a greater preference for completing tasks in the morning, whereas lower scores indicate a preference for completing tasks in the evening. The following set of predictions was assessed.

*H9: Eveningness will be negatively associated with trait procrastination* (anticipated  $r$  = -.35).

*H10: Eveningness will be negatively associated with subjective morning fatigue*  
(anticipated  $r$  = between -.35 and -.45).

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<sup>1</sup> Hess et al. (2000) reversed the scoring of the MEQ, such that higher scores reflected a greater preference for completing tasks in the evening.

Researchers with a large-scale European research network ([www.euclock.org](http://www.euclock.org)) have recently developed another measure to assess the human circadian rhythm based on over 55,000 European participants (see Roenneberg, Wirz-Justice, & Mellow, 2003; Wirz-Justice, 2007). An individual's chronotype, or time-of-day preference, is discerned by the mid-sleep time point on free days (MSF), which is calculated as the mid-point between when an individual goes to sleep and when he/she wakes up. An earlier MSF (e.g., 3am) indicates more of a morning chronotype than a later MSF (e.g., 7am) because an earlier MSF indicates that an individual went to bed early and woke up early. This time point is chosen from free days because people are less constrained on these days by social or work obligations that may influence sleep schedules. Moreover, sleep habits on free days are likely dependent on sleep deficits that may build during the work week, as well as exposure to sunlight (Roenneberg et al., 2003). The Munich Chronotype Questionnaire (MCTQ) measures these variables, allowing researchers to correct MSF based on these values. Therefore, the MCTQ may provide a more accurate measure of time of day preferences because chronotype is determined based on both the individual's preferences and external factors. This measure was given in addition to the MEQ to assess participants' time-of-day preferences.

*Affect.* Affect refers to an individual's subjective emotions and feelings (Eagly & Chaiken, 1998). Watson, Clark, and Tellegen (1988) distinguished between two dimensions of affect in the Positive Affect and Negative Affect Scale measure (PANAS). Positive affect (PA) refers to a state of high energy, concentration, and engagement, whereas negative affect (NA) reflects a state of subjective distress and unpleasurable engagement. Positive and negative affect are measured by two scales representing

separate dimensions, and individuals may report similar levels of positive and negative affect simultaneously. Watson et al. (1988) reported that, among an adult sample, both trait and state NA were strongly associated with extant measures of distress and depression, such as the Hopkins Symptom Checklist (HSCL;  $r$ s between .65 and .74) and the Beck Depression Inventory ( $r$ s between .56 and .58). The PA scale was negatively correlated with these measures, but not as strongly (e.g.,  $r$ s between -.19 and -.29 for the HSCL)<sup>2</sup>.

Procrastination has been studied as both a correlate and a consequence of affect. An individual's trait affect may influence his/her general inclination to procrastinate, or alternatively, procrastination may cause an affective reaction (Stainton, Lay, & Flett, 2000). As discussed above, Pychyl et al. (2000) did not find significant relationships between positive or negative affect and procrastination behavior in-the-moment. Lay (1997), however, reported a significant relationship between self-reported trait procrastination and trait negative affect ( $r = .31, p < .01$ ). Similarly, Steel, Brothen, and Wambach (2001) reported significant relationships between procrastination and both positive and negative affect ( $r = -.34$  and  $r = .34, p < .05$ , respectively). Taken together, these results suggest a relationship between procrastination and affect at the trait level but not at the state level.

Negative affect is also implicated in both state and trait subjective fatigue. Hockey et al. (2000) measured individuals' state affect *through* measures of subjective fatigue and anxiety, suggesting that affect, fatigue, and anxiety are closely related. Similarly, in an assessment of subjective fatigue both before and after SAT tests of varying lengths, Ackerman, Kanfer, and Wolman (2008) found that the trait complex of

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<sup>2</sup> Watson et al. (1988) do not offer  $p$ -values for these correlations but stated that they were significant.

neuroticism/anxiety was significantly associated with pre-test subjective fatigue ( $r$ s between .22 and .31,  $p < .01$ ) as well as post-test subjective fatigue ( $r$ s between .31 and .38,  $p < .01$ ). These findings offer support for a relationship between subjective fatigue and negative affect at both the state and trait levels.

An inverse relationship appears to exist between subjective fatigue and positive affect. For example, Angus and Heslegrave (1985) conducted a sleep-deprivation experiment with undergraduate students over a three-day period, assessing positive and negative affect every hour. Results indicated a significant decline in positive affect ( $F(8,40) = 30.32$ ,  $p < .01$ ) over the course of the study, in a pattern that closely mirrored the increase in reported subjective fatigue. Participants also reported an increase in negative affect ( $F(8,40) = 35.08$ ,  $p < .01$ ) over the three-day period. These results suggest a relationship between subjective fatigue and affect at the state level. The following set of predictions regarding positive and negative affect were assessed.

*H11: Trait procrastination will be positively associated with trait negative affect*  
(anticipated  $r = .30$ ).

*H12: Trait procrastination will be negatively associated with trait positive affect*  
(anticipated  $r = -.30$ ).

*H13: Trait subjective fatigue will be positively associated with trait negative affect*  
(anticipated  $r = .45$ ).

*H14: Trait negative affect will be positively associated with subjective morning fatigue*  
(anticipated  $r = .40$ ,  $f^2 = .16$ ).

*H15: Trait subjective fatigue will be negatively associated with positive affect*  
(anticipated  $r = -.45$ ).

*H16: Trait positive affect will be negatively associated with subjective morning fatigue*  
(anticipated  $r = -.40$ ,  $f^2 = .16$ ).

In summary, several factors may contribute to reported morning subjective fatigue, including sleep disturbance, eveningness preferences, and negative affect. These variables were included in order to determine the influence they may have on average subjective morning fatigue scores for each week. As stated above, however, they were not expected to influence the rank order of fatigue scores over the three-week period.

## CHAPTER 2

### METHODS

#### *Participants*

Undergraduate students from the Georgia Institute of Technology were recruited through an Internet recruiting tool (Experimetrix), flyers around campus, and in-class announcements. Students were included if they used an alarm device to awaken each weekday morning, used the snooze function on their alarm devices at least once per weekday morning, were proficient with the English language, and had normal or corrected-to-normal vision and hearing. Students received up to 5 research credits for participating.

A series of a priori power analyses at the .90 level indicated that 75 experimental participants would provide enough power to detect the smallest hypothesized effects. A total of 80 experimental participants enrolled in the current study. Of these, 47 participants were women (58.75%) and 33 were men (41.25%). The average age was 20.38 ( $sd = 1.42$ ).

Based on trends from preliminary pilot studies, a control group was added for several reasons. First, because this study was conducted several times throughout the Fall 2009 semester, it is possible that participants may have had academic commitments which altered sleep patterns and fatigue (e.g., a week of midterms). Any changes in sleeping patterns or fatigue ratings in the control group that mimicked that of the experimental group might illuminate which weeks were particularly laden with academic requirements. Second, a control group would allow for the exploration of whether the experimental manipulation of restricting morning snooze time would have residual

effects during the final week of the study. A total of 39 control participants enrolled in the current study. Of these, 19 participants were women (48.7%) and 20 were men (51.3%) and the average age was 20.51 ( $sd = 2.04$ ).

Two participants (1 experimental and 1 control) withdrew from the study, reporting that they were too busy to participate. Of these 2 participants, the experimental participant scored 3 standard deviations above other participants on the measure of trait negative affect. This participant's trait scores fell within the range of plus or minus 3 standard deviations of the group mean for all other trait measures, and the control participant fell within this range for all trait measures. These 2 participants are not included in the statistical analyses.

In addition, several participants answered “no” to questions presented in the self-report measures regarding several of the inclusion criteria. For example, the Munich Chronotype Questionnaire asks whether participants use an alarm clock to awaken on school days. Two control participants answered “no.” Similarly, the Snooze Usage Questionnaire asks how many times participants press the snooze button on an average morning. Four control participants answered “zero,” one of which also answered “no” to using an alarm clock to awaken on school days. As these are requirements to be included in the study, these 5 participants were excluded from statistical analyses. These control participants did differ significantly from other control participants on two of the measured traits: self-control/self-regulation ( $t(37) = 2.98, p < .01, d = .98$ ) and mean performance approach ( $t(37) = 2.38, p < .05, d = .78$ ).

Finally, 2 participants (1 control and 1 experimental) reported illness during Week 2 of the study which might have affected sleep patterns and fatigue (e.g., mononucleosis

and the swine flu). These participants did not differ from others on global trait measures. Additionally, paired *t*-tests comparing each participant's daily fatigue scores in Weeks 1, 2, and 3 indicate that they did not report significantly different morning fatigue or afternoon fatigue. However, the experimental participant reported length of nap time during Week 2 that was greater than 3 standard deviations from the mean nap length of other experimental participants during that week. Similarly, the control participant reported snooze time during Week 3 that was 3 standard deviations from mean snooze time of other control participants during that week. Because these participants exhibited different snoozing and napping patterns when compared across weeks and compared to other participants, these participants will not be included in the statistical analyses. Consequently, the final sample consisted of 32 control participants and 78 experimental participants ( $N = 110$ ).

### *Procedure*

The present study followed an A-B-A, within-subjects design in which all participants took part in all three weeks of the study. Data collection began in September 2009 and ended in November of 2009, during which three sessions were conducted. As a result, participants were assessed at different points in the semester. Each session was scheduled such that it would not conflict with any university holidays.

Students signed up for an initial one-hour Saturday lab session via Experimentrix, and could choose one of three session times at which they would complete this session. These three session times were used to assign groups of participants to the experimental or control group, and participants did not know to which group they were assigned until



they arrived at the lab session. The experimental and control conditions differed with respect to the alarm devices used and awakening instructions during Week 2 of the study.

Informed consent was obtained at the beginning of this one-hour lab session before instructions were given regarding study logistics and accessing the online questionnaires. Participants then completed self-report questionnaires assessing procrastination, fatigue, general sleep patterns and snooze function usage, goal orientation, and various personality traits. A description of each measure used in the study is included below. These questionnaires took approximately 30-45 min to complete.

Extensive information regarding how to access the online questionnaires and when to complete them was provided. Each participant was given a note card with the website address of the online questionnaires, as well as an individual user name and password. The online questionnaires were to be completed 15 times per week. Starting on Sunday evenings, participants completed questionnaires in the evening, morning, and afternoon through Friday afternoon. The morning questionnaire was to be completed within 30 min of getting out of bed, the afternoon questionnaire was to be completed between 2pm and 4pm, and the evening questionnaire was to be completed before going to bed.

The experimental group received an alarm clock without a snooze button to use during the second week of the study. Participants in this group received a brief demonstration and a page of instructions detailing how to use this alarm. An opportunity was offered for participants to try using the alarms and ask questions about them at this time. Experimental participants were instructed to use their usual alarm device and

snooze function during Week 1 (Monday-Friday) of the study and to awaken as they typically do. During Week 2, participants were instructed to use the study alarm and to get out of bed as soon as the alarm first rings. Participants were asked to use only the study alarm to awaken during this week, although they were permitted to set a back-up alarm if they were concerned about setting the study alarm properly. They were also advised to set the alarm for the time at which they wish to arise in order to minimize time spent in bed after the alarm ringing and before getting out of bed. During Week 3, participants were asked to return to their normal alarm and snooze function usage. They were not allowed to use the study alarm during this final week. The control group did not receive an alarm device and was instructed to use their normal alarm devices and snooze functions for the duration of the study.

At the end of the third week, participants attended a brief lab session to complete a final questionnaire, return the study alarm, and receive a debriefing statement. If participants had a scheduling conflict with either lab session, alternative arrangements were made, including completing aspects via email or during the week. The entire duration of the study was approximately 4.5 hours.

In order to reduce the number of missing online questionnaires, three steps were taken. First, participants received a study calendar to aid in keeping track of which questionnaires to complete on which days. Second, reminder e-mails were sent to participants on each day an online questionnaire was to be completed. These e-mails included the website address of the questionnaires, as well as a way for participants to look up their IDs and passwords. Finally, research credit was pro-rated such that

participants received .067 research credits for each online questionnaire completed, and 1 research credit for each lab session completed.

### *Measures*

Three types of measures were administered during the course of this study, including global trait measures, daily measures, and a retrospective final questionnaire, each of which will be discussed in turn below. Table 1 contains the means, standard deviations, and coefficient  $\alpha$  values for all global trait measures completed during the first lab session. Nunnally (1978) indicated that reliability of .80 or higher is adequate for well-established measures, and .70 or higher is acceptable for newer measures. Internal consistency estimates for the global measures were above .70 for all measures except one ( $\alpha = .67$ ). The internal consistency for the majority of the trait measures (14 of 21) was greater than .80.

#### *Global Measures*

*General snooze function usage.* Participants reported their general snooze function usage, including how many times they press the snooze button on an average morning, how long they spend in bed asleep after their alarms initially go off, and how their snooze usage might affect any roommates they have. This measure was included to obtain a broad portrayal of participants' snoozing habits, as well as to ensure that participants met inclusion criteria. Tables 2 and 3 display descriptive statistics and frequencies for items included in this questionnaire.

Table 1

Means, Standard Deviations, and Observed Internal Consistency for all Trait Measures

Variables	# of Items	<i>M</i>	<i>SD</i>	$\alpha$
Procrastination	15	2.73	.76	.86
Performance	3	4.50	.96	.82
Approach				
Mastery	3	4.08	.87	.67
Avoidance				
Mastery	3	4.60	.80	.73
Approach				
Performance	3	4.43	1.03	.71
Avoidance				
Overall Fatigue	11	3.20	.93	.90
Physical Fatigue	7	3.36	.98	.88
Mental Fatigue	4	2.92	1.13	.82
Sleep Disturbance	4	2.43	.72	.70
Morningness-	19	2.16	.39	.76
Eveningness				
Positive Affect	9	5.30	.93	.86
Negative Affect	10	2.82	.98	.86
Conscientiousness	10	4.28	.71	.84
Impulse Control	9	4.09	.69	.77
Extraversion	10	3.77	.96	.91
Neuroticism	10	2.77	.82	.87
Resourcefulness	9	4.32	.73	.85
Self-Regulation	11	3.85	.71	.76
/Self-Control				
Perfectionism	9	4.14	.82	.84
Curiosity	10	4.33	.64	.80
Anxiety	9	3.56	.83	.86

*Note.* N = 110.

Table 2

Means and Standard Deviations for Self-Reported General Snooze Function Usage

Condition	Item	<i>M</i>	<i>SD</i>
Experimental	Snooze Button <sup>a</sup>	2.46	1.22
	Snooze Time <sup>b</sup>	17.04	10.79
Control	Snooze Button <sup>a</sup>	2.19	1.06
	Snooze Time <sup>b</sup>	17.81	12.81

*Note.* <sup>a</sup>Snooze button measured in number of times the snooze button was pressed per day. <sup>b</sup>Snooze time measured in minutes.

Table 3

Alarm Setting and Roommate Information as Percentage of the Sample

Item									
	SAW		RMT		AAR <sup>a</sup>			SAR <sup>a</sup>	
Group Unsure	Yes	No	Yes	No	Yes	No	Unsure	Yes	No
Experimental 20.5 (n = 78)	51.3	48.7	84.6	15.4	17.9	46.2	20.5	15.4	48.7
Control 25.0 (n=32)	43.8	56.3	84.4	15.6	21.9	37.5	25.0	12.5	46.9

*Note.* SAW = set alarm on weekends; RMT = one or more roommate; AAR = alarm awoken roommate(s); SAR = usage of snooze function affect roommate(s).

<sup>a</sup>Percentages listed as valid percentages of those who answered “yes” to RMT.

On average, participants in both the experimental and control groups reported pressing the snooze button a little over two times per morning and snoozing for approximately 17 min after the alarm first rings. Approximately half of the participants in the experimental and control groups reported setting their alarms on weekends. The majority of participants reported having one or more roommate(s), and also reported that their alarm usage generally did not awaken or affect their roommate(s). A copy of this measure is included in Appendix A.

*Procrastination.* Procrastination was assessed using Adult Inventory of Procrastination (AIP; McCown & Johnson, 1989a; 1989b, cited in Ferrari et al., 1995), which assesses procrastination of everyday tasks such, such as paying bills, arriving on time to appointments, and routine car maintenance. The AIP consists of 15 items, 7 of which are reverse scored. Responses were given on a 6-point scale indicating whether respondents strongly disagree (1) or strongly agree (6) with each statement. An overall score represents a measure of the individual's global procrastination, with lower scores indicating a lower tendency to procrastinate. The wording of two items was slightly altered from pertaining to "appointments" to "engagements" to include the many types of appointments students may encounter. The internal consistency found in this study ( $\alpha = .86$ ) is consistent with previous findings reported by McCown and Johnson ( $\alpha = .79$ ; 1989b). A copy of this measure is provided in Appendix B.

*Achievement Goal Orientation.* The Achievement Goal Orientation Questionnaire (Elliot & McGregor, 2001) was given to assess participants' goal orientation along two axes: performance-mastery and approach-avoidance dimensions. This questionnaire consists of 12 items, with three items pertaining to each of the four

quadrants of possible goal orientations. Questions focused on goals within a college setting, such as GPA, course learning, and comparison among college students. Responses were given on a 6-point scale ranging from Very UNTRUE of me (1) to Very TRUE of me (6).

The internal consistencies of these subscales are somewhat lower than that reported by Elliot and McGregor (2001). In the current study, the coefficient alpha was adequate for performance approach ( $\alpha = .82$ ), but was somewhat lower for mastery approach ( $\alpha = .73$ ), performance avoidance ( $\alpha = .71$ ), and mastery avoidance ( $\alpha = .67$ ). Collapsing across the various dimensions did not yield higher internal consistencies, suggesting that each scale does measure a distinct construct and that the scales should not be combined. Coefficient alpha values obtained in Elliot and McGregor's (2001) research were relatively higher, with  $\alpha = .89$  for mastery-avoidance,  $\alpha = .87$  for mastery-approach,  $\alpha = .92$  for performance-approach, and  $\alpha = .83$  for performance-avoidance. However, the questions in the Elliot and McGregor (2001) version pertained only to one college course, whereas the questions in the current study referred to feelings regarding college courses in general. It seems likely that students would have greater variability in responses regarding many courses than responses regarding just one course, which would decrease the internal consistency of each 3-item measure. A copy of this measure is provided in Appendix C.

*Fatigue.* The fatigue scale developed by (Chalder et al., 1993) was used to assess both trait and state subjective fatigue. Trait fatigue will be discussed here, and state fatigue will be discussed below with the daily online measures. The original version of this scale consists of 14 items, with 6 items assessing mental fatigue and 8 items

assessing physical fatigue. Responses were given in yes/no form. For the current study, 3 items were removed due to vagueness. Additionally, the response-scale was altered to be consistent with the other trait measures given. The measure used in the current study consists of 11 items, 4 pertaining to mental symptoms of fatigue and 7 pertaining to physical symptoms. Participants were asked to indicate the degree to which they agreed or disagreed with each statement on a 6-point scale ranging from Strongly Disagree (1) to Strongly Agree (6). Scores on each subscale were obtained by summing the item scores within each scale. A composite score of overall fatigue was obtained by summing the scores on all items. Higher scores indicated greater subjective fatigue. Similar to results reported by Chalder et al. (1993), adequate alpha coefficients were obtained in the current study for both the physical ( $\alpha = .90$ ) and mental (.82) subscales, as well as the overall measure of subjective fatigue ( $\alpha = .88$ ). A copy of this measure is provided in Appendix D.

*Sleep Disturbance.* The Karolinska Sleep Questionnaire (KSQ; Akerstedt et al., 2002a; Akerstedt et al., 2004) was included to assess general sleep disturbance. This measure consists of four items: difficulties falling asleep, disturbed sleep, repeated awakening, and premature awakening. Responses were given on a 5-point scale ranging from Never (1) to Very Often (5), and higher scores indicated greater sleep disturbance. The internal consistency obtained in the current study ( $\alpha = .70$ ) is similar to the alpha coefficient of .76 reported by Akerstedt et al. (2002a; 2004). Though an internal consistency between .70 and .79 is thought of as somewhat low, it does fall within the accepted range for a relatively new scale (Nunnally, 1978). A copy of this measure is provided in Appendix E.



*Time-of-Day Preferences.* Two measures were used to assess variations in daily functioning and time-of-day preferences attributable to an individual's circadian rhythm. The Morningness-Eveningness Questionnaire (MEQ) was originally developed by Öquist (1970) and adapted by Horne and Östberg (1976) for English-speaking participants. Results from Posey and Ford (1981) suggests that this version is also valid among US college students. The MEQ consists of 19 items regarding individual preferences towards time of waking and going to bed, physical and mental performance, and alertness after waking and before bed. Scores from each item are summed and the total scores range from Extreme Eveningness (16) to Extreme Morningness (86).

Based on the suggestion of several investigators (Adan & Almirall, 1991; Neubauer, 1992), the response format was altered for several of the items. The original scale restricts the range of times offered for participants to choose from on several items (e.g., "Indicate between 8pm and 3am when you are most likely to go to bed."), which resulted in skewed responses. A more open-ended response format was offered in the current study for Questions 1, 2, and 10 that is similar to Questions 17 and 18 in allowing participants to choose from any time of the day. Response scales to other items typically include three or four options for participants to choose from, and the responses are scored based on Horne and Östberg's (1976) scoring rubric.

The internal consistency obtained in the current study was adequate at  $\alpha = .76$  and consistent with previous findings of  $\alpha = .80$  (Hess et al., 2000). Adan and Almirall (1991) proposed a reduced version of the MEQ which contains 5 of the original 19 items, to focus on the Morningness dimension in a broader population of both students and working adults. However, these 5 items yielded lower internal consistency in the present

study than the original 19-item scale ( $\alpha = .58$ ). This low value is not surprising given that the reduced scale was proposed for a broader population than was used in the current study, as well as the fact that coefficient alpha is influenced by the number of items in a given scale (Cronbach, 1951). A Spearman correlation suggested that the rank ordering of individuals on both scales was relatively similar ( $r = .87, p < .01$ ). Additionally, the total values on both the original and reduced scale, which could be used to classify individuals into morning or evening “types”, fall within the “Moderately Evening Type” category ( $M_{\text{original}} = 32.46, sd = 5.95$ ;  $M_{\text{reduced}} = 11.71, sd = 3.11$ ). These values along with the strong correlation between the two scales suggest that both classify individuals in a similar manner. Based on the stronger reliability, the original 19-item scale will be used in the present study. A copy of this measure may be found in Appendix F.

The Munich Chronotype Questionnaire (MCTQ) was used as a second measure to increase the construct validity of time-of-day preference measurement in the current study. This self-report measure consists of 16 questions regarding sleeping and waking habits on work days and on free days, as well as time spent in sunlight during the day in order to assess an individual’s time-of-day preference, or chronotype. The mid-sleep time point during free days (MSF) was moderately correlated with the MEQ ( $r = -.50, p < .01$ ), which aligns with previous findings (Zavada, Gordijn, Beersma, Daan, & Roenneberg, 2005). This correlation suggests that individuals who reported greater morningness tendencies on the MEQ also reported earlier (e.g., 3am or 4am) mid-sleep time points on free days. Similarly, the mid-sleep time point during school days (MSS) was moderately correlated with the MEQ ( $r = -.41, p < .01$ ). These findings support the

construct validity of the MEQ in that it is related to sleep patterns on free days and on school days. A copy of this measure is provided in Appendix G.

*Affect.* Trait affect was assessed with the Positive Affect and Negative Affect Scale (PANAS; Watson et al., 1988). The original scale consists of 20 adjective, 10 of which pertain to positive affect (PA) and the other 10 of which pertain to negative affects (NA). One item was removed from the PA scale (*alert*), as it overlaps with items in the MEQ and CFS. Responses were given on an 8-point scale ranging from Not at All (1) to Extremely (8). The scale is bi-dimensional, as PA and NA have been shown to be qualitatively different constructs (Watson et al., 1988). As a result, higher scores on each scale indicate higher levels of that particular affect. The internal consistencies of both scales were adequate, with  $\alpha = .86$  for both PA and NA. These findings are consistent with previous research by Watson et al. (1988), in which the alpha coefficients were  $\alpha = .90$  for PA and between .84 and .87 for NA. A copy of this measure is provided in Appendix H.

#### *Personality Measures*

Several personality measures from the International Personality Item Pool (<http://ipip.ori.org>; Goldberg et al., 2006) were included to assess the construct validity of procrastination and also to assess levels of trait self-regulation. These scales include Conscientiousness, Impulse Control, Extraversion, Neuroticism, Resourcefulness, Self-Regulation/ Self-Control, Perfectionism, Curiosity, and Anxiety, for a total of 87 items. Items were presented in random order such that items from each scale were not presented together, and responses were given on a 6-point scale ranging from Very UNTRUE of me (1) to Very TRUE of me (6). Internal consistencies obtained in the current study are

compared to those presented on the website for each IPIP scale. A copy of each personality scale is provided in Appendix I

*Conscientiousness.* A 10-item scale of conscientiousness was used. Reverse scoring was applied to 4 of these items. The alpha coefficient obtained in the current study of  $\alpha = .84$  was similar to the recorded  $\alpha = .79$ . Additionally, conscientiousness has been shown to be moderately and negatively correlated with procrastination (e.g., Lay, 1997; Lay, Kovacs, & Danto, 1998; C. H. Lay & Brokenshire, 1997; Lee, Kelly, & Edwards, 2006), and this finding was replicated in the current study with a moderate negative correlation between this scale and the AIP ( $r = -.59, p < .01$ ).

*Impulse Control.* A 9-item scale of impulse control was included, with 7 of the 9 items reverse-scored. The internal consistency of this measure was  $\alpha = .77$ , which aligns with the recorded  $\alpha$  of .78. Several studies have investigated the relationship between impulsivity and procrastination (e.g., Ferrari & Tice, 2000; Johnson & Bloom, 1995; Schouwenburg & Lay, 1995), reporting correlations between  $r = .26$  and .40. It should be noted that impulsivity is the opposite of impulse control, which was assessed in the current study. Findings here align with previous results, with a moderately negative correlation between impulse control and the AIP ( $r = -.28, p < .01$ ).

*Extraversion.* A 10-item scale of extraversion was included. Half of the items are reverse-scored. The alpha coefficient found in the current study of  $\alpha = .91$  is consistent with the recorded  $\alpha$  of .87. Previous studies have reported a range of correlations between extraversion and procrastination from not significant (Dewitte & Schouwenburg, 2002) to moderately negative (Milgram & Tenne, 2000). A nonsignificant relationship was found in current study between extraversion and procrastination ( $r = -.09, ns$ ).

*Neuroticism.* Neuroticism was assessed with a 10-item scale, with 5 items reverse-scored. The internal consistency in the current study of  $\alpha = .87$  is similar to with the reported  $\alpha$  of .86. Research has demonstrated a small to moderate relationship between neuroticism and procrastination (e.g., Lay, 1997; Lee et al., 2006; Milgram & Tenne, 2000), a finding which was also replicated in the current study. A moderate relationship between this measure of neuroticism and the AIP was found ( $r = .36, p < .01$ ).

*Self-Regulation/Self-Control.* An 11-item scale was used to assess self-regulation/self-control, 6 of which are reverse-scored. The internal consistency found in the current study ( $\alpha = .76$ ) is consistent with the reported  $\alpha$  of .75. This measure was included to assess participants' level of trait self-regulation, as self-regulatory processes are proposed to occur during procrastination but are not directly assessed in the current study. Howell and Watson (2007) reported moderate negative correlations between procrastination and metacognitive and cognitive strategies (which include planning, monitoring, organization, rehearsing, elaboration, and regulating), such that individuals with greater tendencies to procrastinate report less use of cognitive and metacognitive strategies. A negative correlation was also found in the present study between this scale of self-regulation/self-control and the AIP ( $r = -.66, p < .01$ ). This finding suggests that, at the trait level, individuals who have a greater tendency to procrastinate have less of a tendency to engage in self-regulation or self-control.

*Resourcefulness.* The resourcefulness scale used in the current study contains 9 items, 4 of which are reverse-scored. An adequate alpha coefficient of  $\alpha = .85$  was found in the current study, similar to the reported  $\alpha$  of .83. This measure was included to provide convergent validity for the self-regulation/self-control measure described above,

as both self-regulation and resourcefulness represent types of metacognitive strategies (Wolters, 2003). As expected, a moderate positive relationship was found between resourcefulness and the self-regulation/self-control scale ( $r = .40, p < .01$ ). Researchers have also reported a moderate negative correlation between resourcefulness and procrastination ( $r = -.30$ ; Milgram, Dangour, & Raviv, 1992), a finding which was replicated in the current study between resourcefulness and the AIP ( $r = -.36, p < .01$ ).

*Perfectionism.* A 9-item scale was used to assess perfectionism. Two of the items were reverse-scored. An adequate internal consistency was found in the present study ( $\alpha = .84$ ) compared to the reported  $\alpha$  of .76. Past research has reported a positive correlation between self-oriented perfectionism and procrastination (e.g., Flett, Blankstein, & Martin, 1995; Flett, Hewitt, & Martin, 1995); however, a negative correlation was found in the current study between perfectionism and the AIP ( $r = -.24, p < .05$ ).

*Curiosity.* Curiosity was assessed with a 10-item scale, with only one of the items reverse-scored. The alpha coefficient found in the present study ( $\alpha = .80$ ) is consistent with the reported  $\alpha$  of .78. This scale was included based on past research exploring the relationship between procrastination and openness to experience, which includes intellectual curiosity and openness (e.g., Steel, 2007). Similar to previous findings, a nonsignificant relationship was found in the present study between curiosity and the AIP ( $r = .01, ns$ ).

*Anxiety.* A 9-item scale was used in assessing anxiety, and 2 of these items were reverse-scored. The internal consistency of this scale was strong with  $\alpha = .86$ , which is consistent the reported  $\alpha = .80$ . Previous research has found a small to moderate positive

relationship between procrastination and anxiety (Milgram et al., 1992; Solomon & Rothblum, 1984), a finding which was replicated in the present study ( $r = .44, p < .01$ ).

*Summary.* These personality scales offer convergent and divergent validity for the AIP scale of procrastination (McCown & Johnson, 1989b). As expected, the AIP was positively related to scales of neuroticism and anxiety, and negatively related to conscientiousness, impulse control, self-regulation/self-control, and resourcefulness, and was not related to extraversion or curiosity.

#### *Daily Online Measures.*

Participants completed 15 online questionnaires per week starting Sunday evening and ending Friday afternoon. Questionnaires were completed within 30 min of awakening, between 2pm and 4pm, and before going to bed. These questionnaires assessed sleeping, napping, and waking habits, and included questions regarding alarm set time, snoozing time, sleep time, nap time, engaging in activities before arising, and the number of alarms set. Copies of these questionnaires may be found in Appendix J.

Snooze time was calculated as the number of minutes that elapsed between the alarm first ringing and the time at which participants reported getting out of bed. If the participant reported awakening before the alarm first rang, snooze time was calculated from this time until the time at which the participant got out of bed. An adjusted snooze time was also calculated by subtracting the time the participant reported engaging in an activity after the first alarm ring and before getting out of bed from snooze time. This adjusted snooze time was used in several analyses.

Table 4 displays the average amount of snooze time and adjusted snooze time per week for experimental and control participants. Experimental participants snoozed an

average of approximately 47 min per day during Week 1, 37 min per day during Week 2, and 44 min per day during Week 3. Control participants snoozed an average of approximately 49 min per day during Week 1, 42 min per day during Week 2, and 43 min per day during Week 3. The averages for adjusted snooze times decreased approximately 4 min on average, indicating that participants engaged in activities before getting out of bed an average of 4 min per week. It should be noted that these weekly averages are higher than the self-reported daily average snooze times displayed in Table 2 of approximately 17 min.

Figures 1 and 2 display the relative frequencies of snooze times in half-hour segments each week for experimental and control group participants, respectively. The majority of reported snooze times were less than 30 min during each of the 3 Weeks for both groups. The median amount of snooze time during Week 1 was 25 min for both the experimental and control groups. During Week 2, the median decreased to 10 min for the experimental group and 18 min for the control group. The median snooze time during Week 3 was 25 min for the experimental group and 20 min for the control group. The frequency of participants who snoozed between 30 min and one hour was almost half of the frequency of those who snoozed between 0 and 29 min, and frequencies decreased steadily after that over with each increase in 30-min segments. However, there was an increase in the number of participants who snoozed for 3 hours or more in both the experimental and control groups during all 3

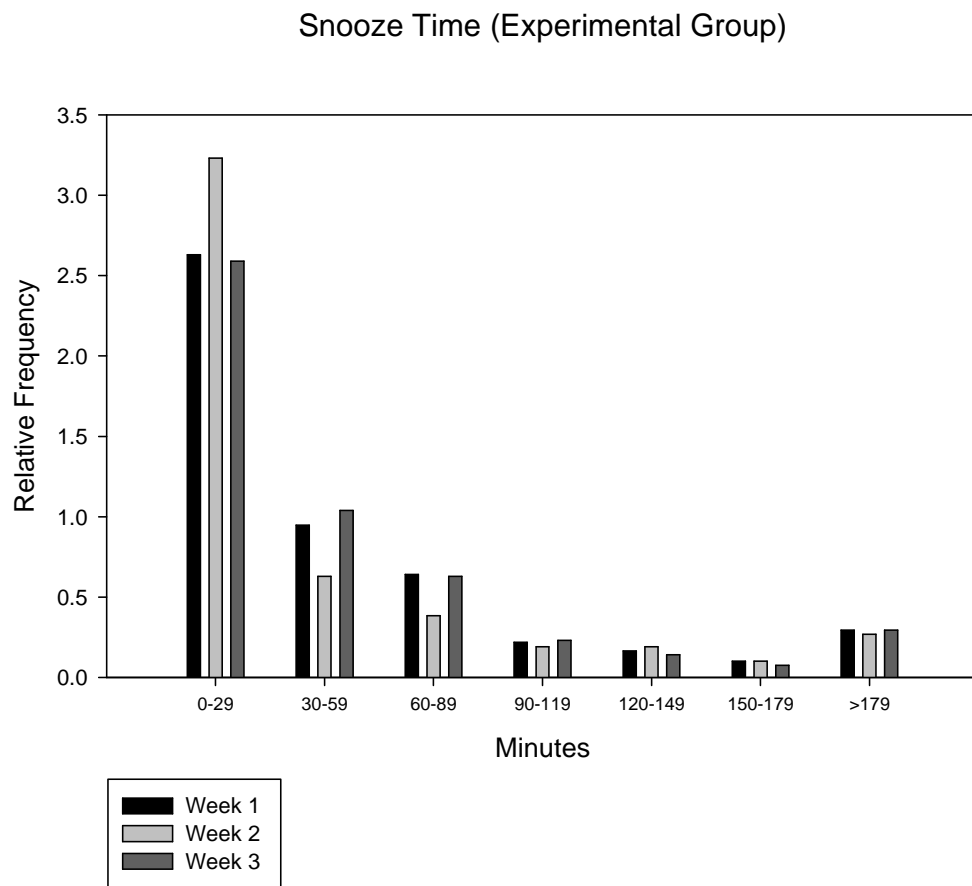


Table 4

Average Number of Minutes Spent Snoozing per Day during Each Week

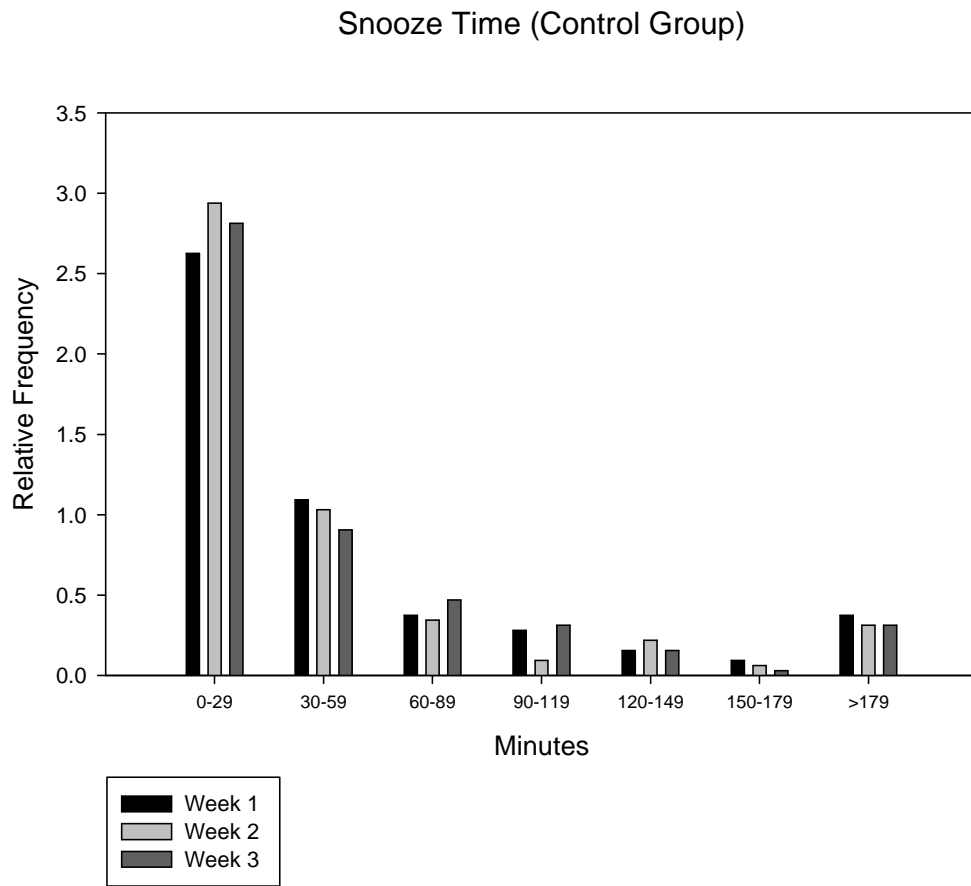
	Experimental Group (n=78)		Control Group (n=32)	
Snooze Time	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Original				
Week 1	47.03	33.72	49.64	40.45
Week 2	37.86	34.17	42.54	42.83
Week 3	44.11	37.98	43.84	46.35
Adjusted				
Week 1	41.64	33.02	46.71	41.02
Week 2	33.37	34.80	38.30	39.77
Week 3	38.90	39.26	40.95	49.62

Figure 1



*Note.* N=78.

Figure 2



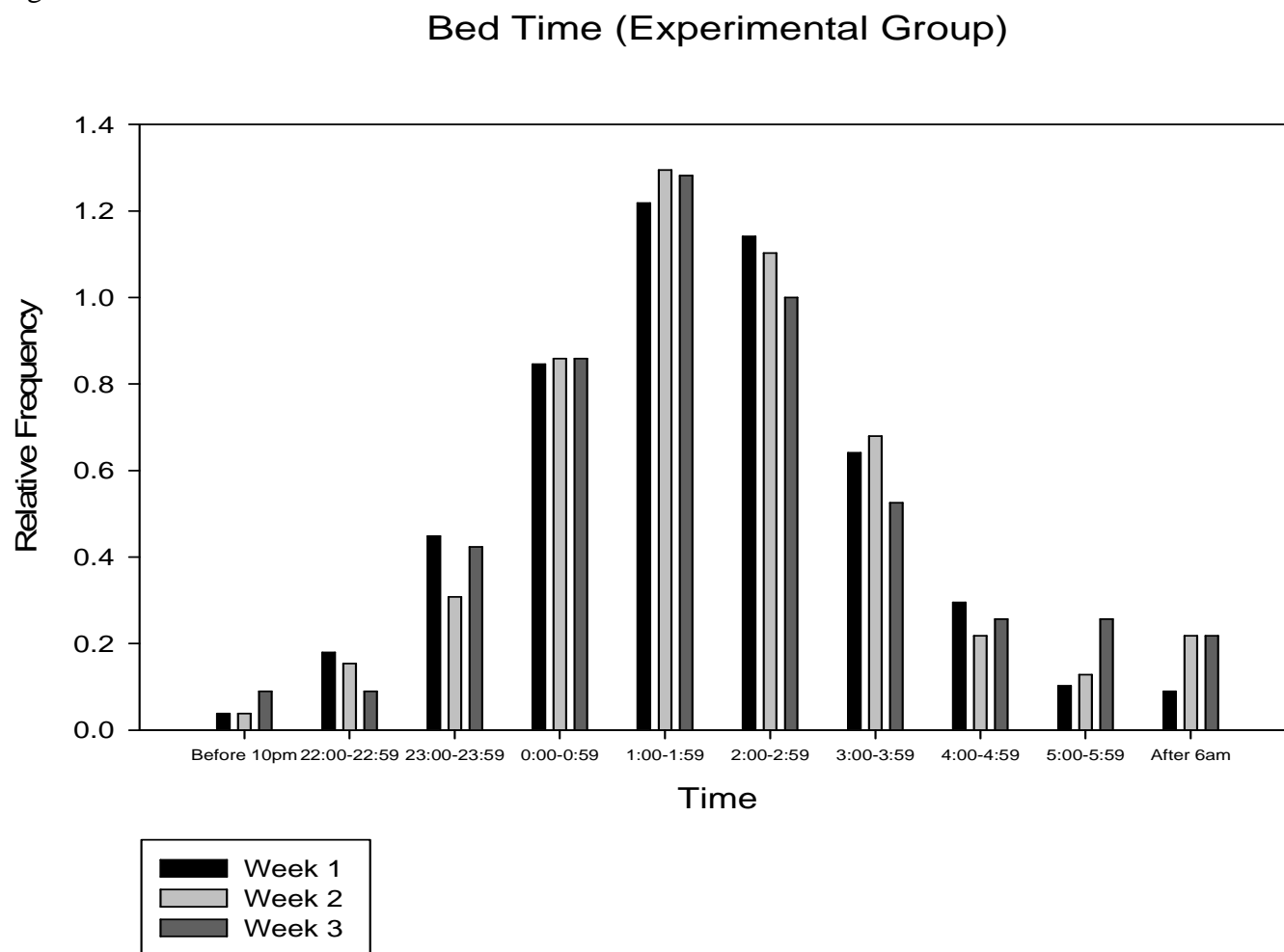
weeks, suggesting that a small subset of participants snoozed for long amounts of time on some mornings.

Participants in both the experimental and control conditions slept between 6 and 8 hours on average, although the timing of when participants went to sleep and woke up varied. Figures 3 and 4 display the relative frequencies of the times at which experimental and control participants went to sleep each night. The majority of participants in both groups went to bed between midnight and 3am during all 3 Weeks, with the hour from 1am to 2am receiving the highest frequencies.

Figures 5 and 6 contain the relative frequencies of times at which experimental and control participants set their alarms each morning, and Figures 7 and 8 display the relative frequencies of times at which participants in each group got out of bed. Since the highest frequency of snooze times fell between 0-29 min, these Figures are displayed in half-hour increments. In both groups, the majority of the frequencies of the time at which the alarm was set during all 3 Weeks were between 8:00-8:29am. However, the highest frequency in the experimental group was between 7:00-7:29am during Week 1.

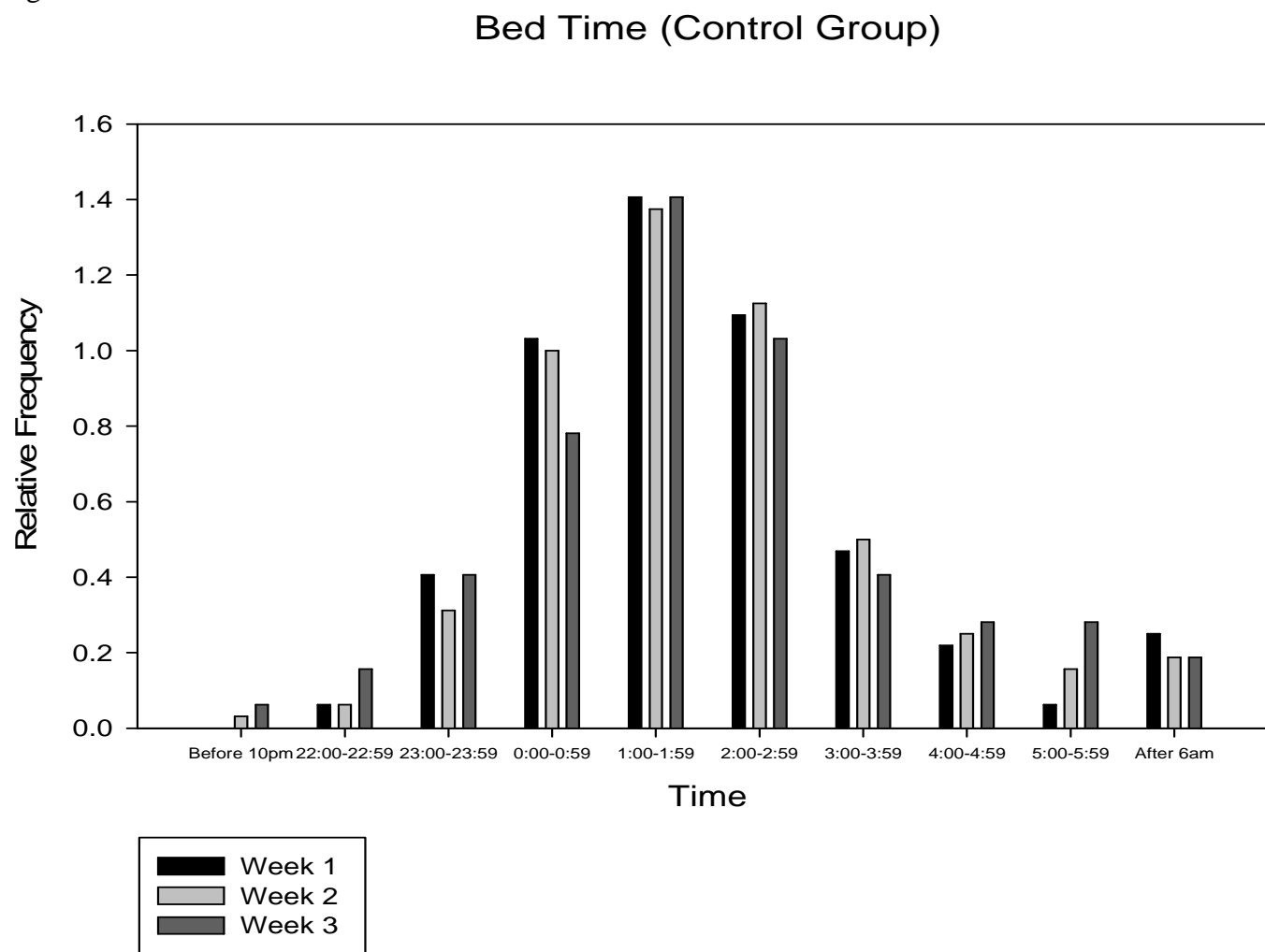
The time period with the highest frequencies for getting out of bed was also 8:00-8:29am for both groups. Interestingly, the frequencies for getting out of bed during Week 2 follow the alarm set time frequencies more closely than they do during Weeks 1 or 3, suggesting that experimental participants generally followed directions to get out of bed when the alarm first rang during Week 2. It should also be noted that there was a spike in frequencies for both groups of participants who got out of bed after 12pm during Week 3, which supports the snooze time frequency charts showing that several participants in both groups “snoozed” for over 3 hours before getting out of bed.

Figure 3



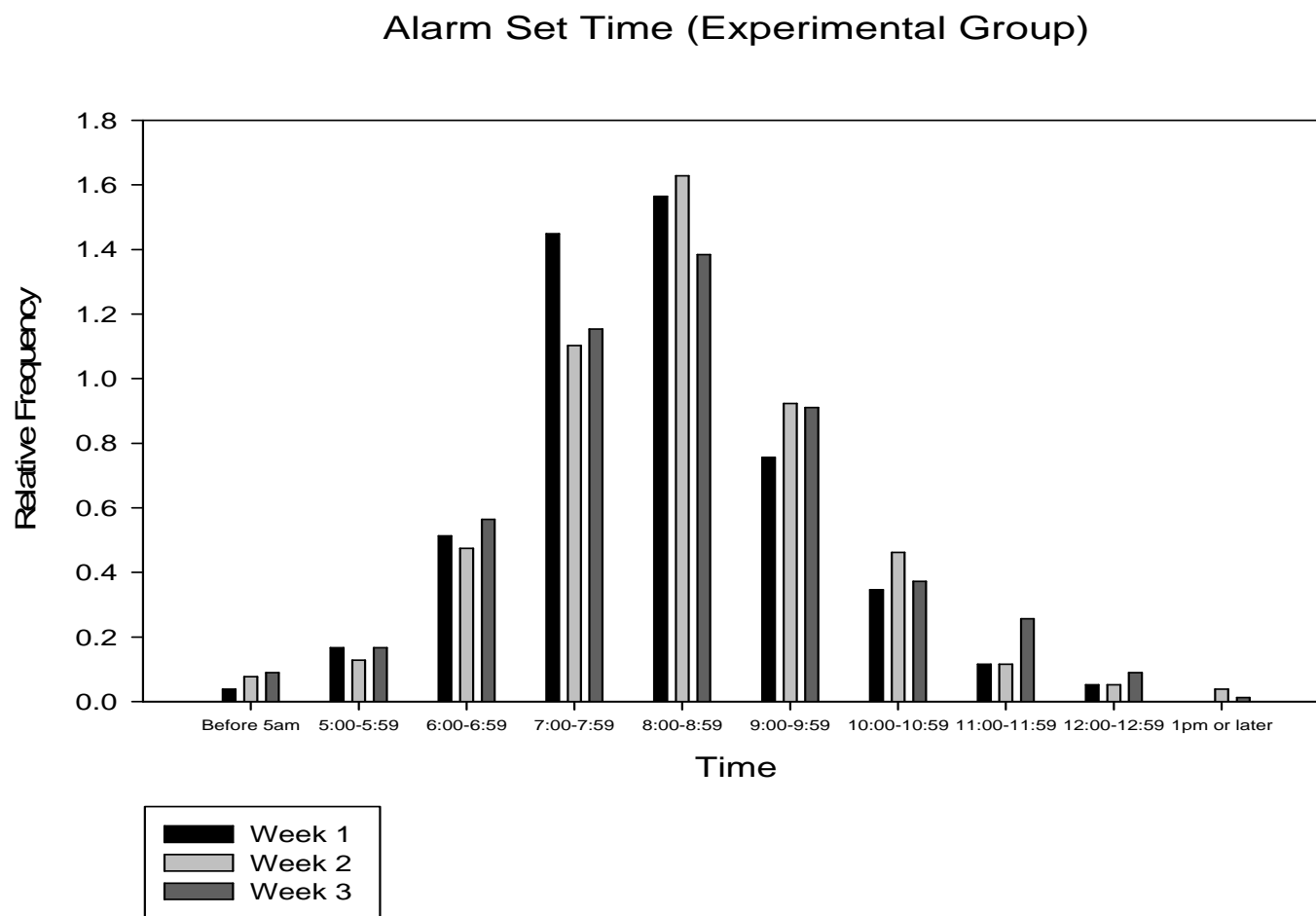
*Note.* N=78

Figure 4



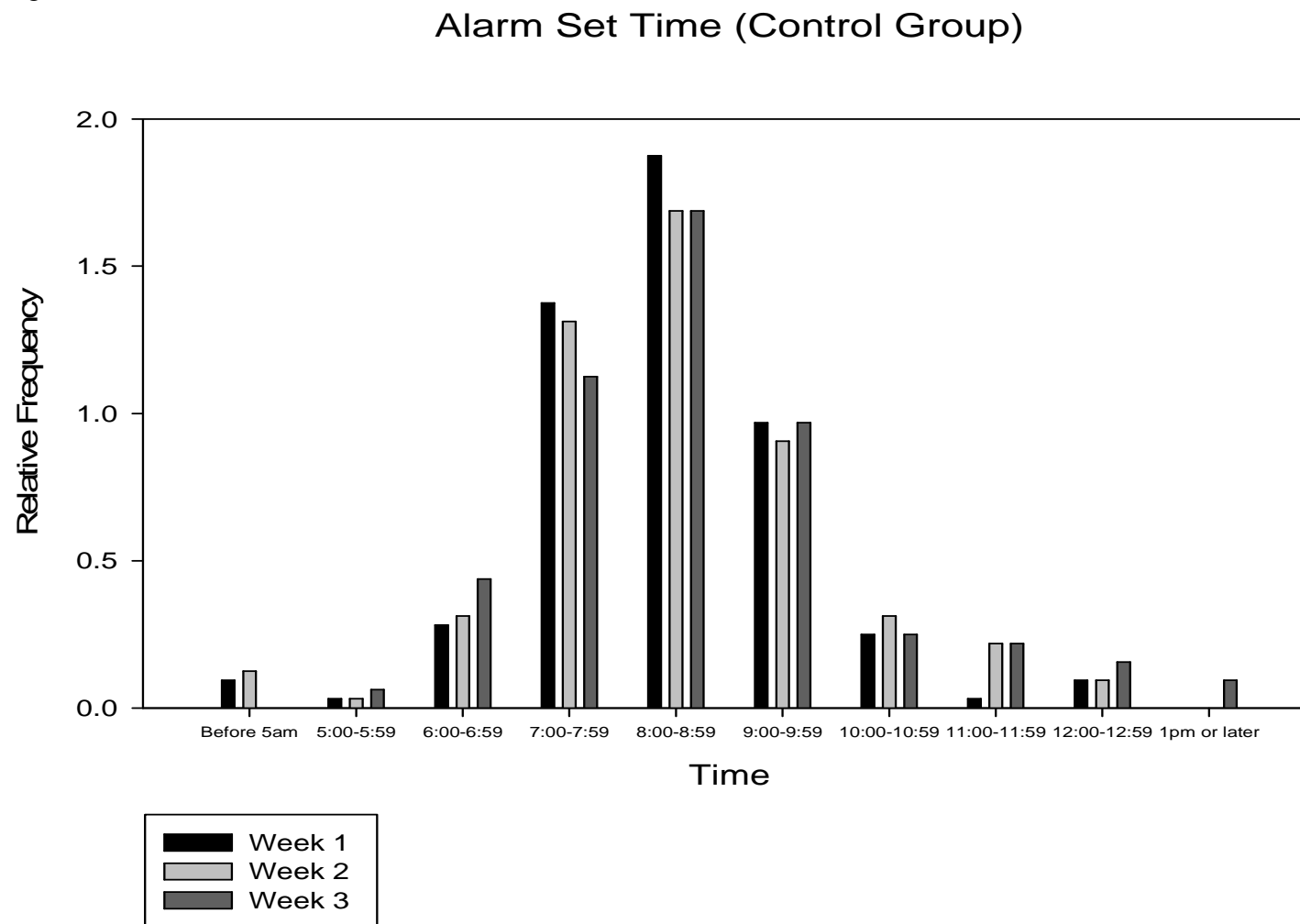
*Note.* N=32

Figure 5



*Note.* N=78

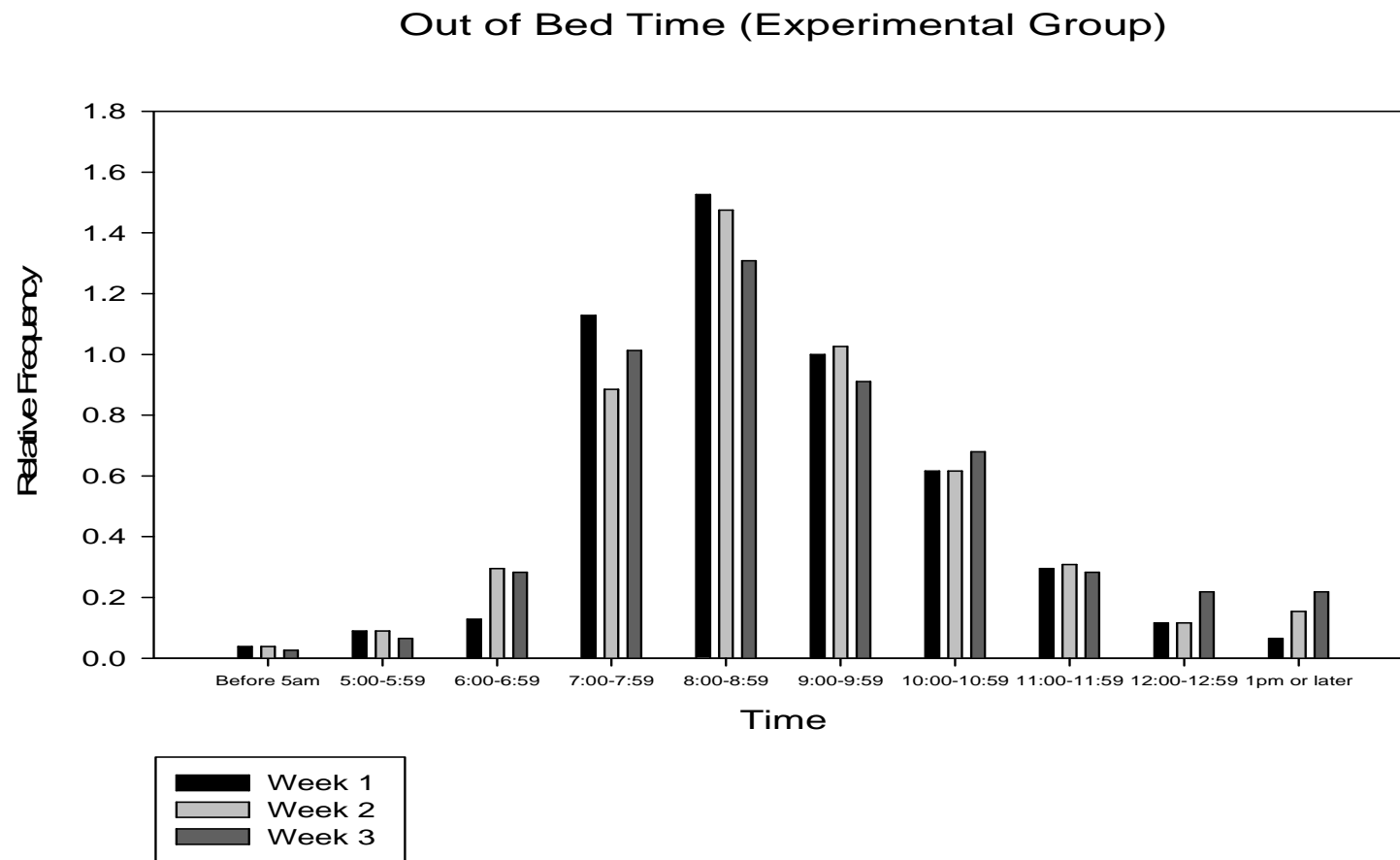
Figure 6



Note. N=32

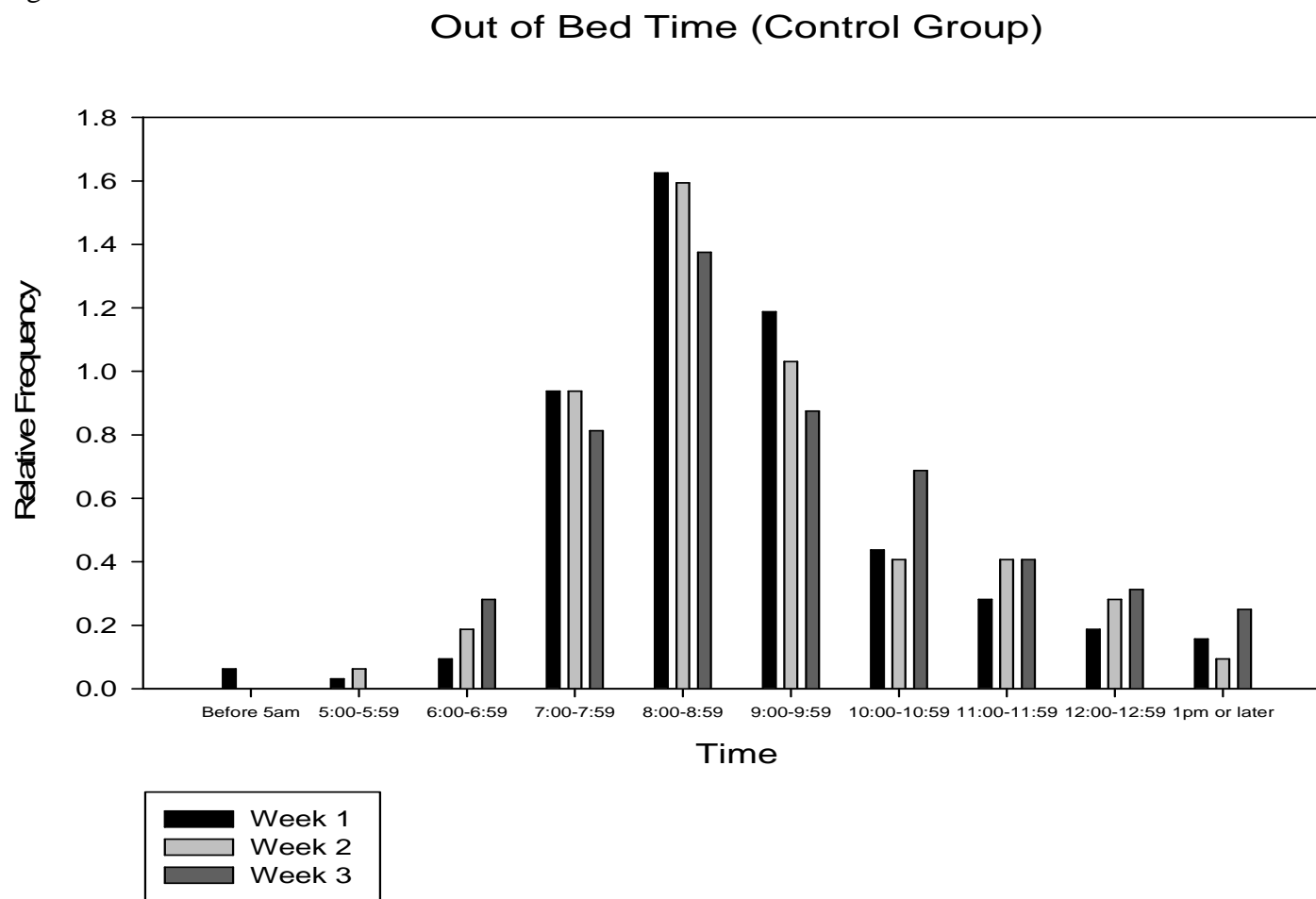


Figure 7



*Note.* N=78

Figure 8



*Note.* N=32

Because participants could access the online questionnaires at any time of the day, the time at which they completed each questionnaire, and whether or not it was completed on time, was also coded. Questionnaires that were completed outside the designated time frame but within 24 hours of the designated time frame were counted as late, and any questionnaire completed after 24 hours had elapsed was not included in the analyses. Any questionnaire completed before the designated time frame was counted as early.

Up to 4950 questionnaires could have been completed by the 110 participants over the 3-week period. Table 5 shows the number and percentages of on-time, late, early, and missing questionnaires.

Table 5

Percentages of On-Time, Late, Early, and Missing Questionnaires

Time Point	Late	On-Time	Early	Missing
Morning	12.00	18.36	1.45	1.52
Afternoon	14.16	13.94	1.41	3.82
Evening	2.10	29.33		1.90
Total	28.26	61.63	2.90	7.23

*Note.* Percentages out of a total possible 4950 questionnaires for experimental and control groups combined.

The afternoon time point yielded the highest late and missing questionnaires and the evening time point yielded the highest on-time questionnaires. It should be noted that there was no specific time frame for participants to complete the evening questionnaire, as the instructions indicated that participants should complete the questionnaire at any time before going to bed. There was no option to complete the evening questionnaires early; they were either on time, late, or missing. These requirements were less stringent than the morning and afternoon questionnaire, resulting in more on-time questionnaires for this time point. The majority of questionnaires was completed on time (61.63%), and the number of missing questionnaires was relatively low at 358 (7.23%).

Trait fatigue and self-regulation were weakly related to the number of afternoon questionnaires completed on time, such that those higher in fatigue had fewer on-time afternoon questionnaires ( $r = -.22, p < .05$ ) and those higher in self-regulation/self-control had more on-time afternoon questionnaires ( $r = .19, p < .05$ ). In addition, trait fatigue was related to the number of afternoon questionnaires completed early and late, such that those higher in overall fatigue had more late afternoon questionnaires ( $r = .34, p < .01$ ). No significant relationships were found between trait procrastination, self-regulation, or overall fatigue and the timing of the morning or evening questionnaires. And no significant correlations were found between the average number of minutes late for morning and afternoon questionnaires and mean procrastination, overall fatigue, or self-regulation.

However, results indicated mostly significant correlations between snooze time during all three weeks and both the number of late afternoon questionnaires and the average lateness of afternoon questionnaires in minutes. Those who spent more average time

snoozing each week also completed a greater number of afternoon questionnaires late during Week 1 ( $r = .26, p < .01$ ), Week 2 ( $r = .31, p < .01$ ), and Week 3 ( $r = .22, p < .05$ ). Similarly, those who spent more average time snoozing each week completed the afternoon questionnaires relatively later Weeks 2 ( $r = .22, p < .05$ ) and Week 3 ( $r = .28, p < .05$ ) but not Week 1 ( $r = .17, ns$ ). These correlations taken together with the lack of significant correlations found between both trait procrastination and self-reported behavior delay suggest that behavioral measures of procrastination are more strongly related to delay behaviors than self-report measures.

The fatigue scale developed by (Chalder et al., 1993) was used to assess state subjective fatigue on the morning and afternoon questionnaires. The details of this measure are discussed above under trait measures. Directions were slightly altered in order to assess current feelings of fatigue rather than overall feelings of fatigue. Fisher's  $r$ -to- $z$  transformation was implemented using the imputed data set (see below for elaboration) to obtain the average test-retest reliabilities among and between morning and afternoon state fatigue assessments. These reliabilities may be found in Table 6, along with means and standard deviations for these time points. It should be noted that these test-retest reliabilities are relatively low, probably for two reasons. First, state fatigue is likely to fluctuate throughout the day and over the course of the week, and it was not expected that daily assessments of state variables will be as consistent with one another, compared to assessments of trait variables. Second, when values were imputed using the Expectation

Table 6

Means, Standard Deviation, and Average Test-Retest Reliabilities for State Fatigue Measurement

Time Point	Week	<i>M</i>	<i>SD</i>	Reliability
Morning	1	2.88	1.12	.49
	2	2.88	1.35	.54
	3	2.88	1.35	.56
	1-3	2.85	1.24	.41
Afternoon	1	2.62	1.41	.44
	2	2.55	1.62	.20
	3	2.52	1.12	.28
	1-3	2.56	1.38	.24
Morning- Afternoon	1	2.75	1.26	.49
	2	2.71	1.48	.44
	3	2.66	1.18	.35
	1-3	2.71	1.31	.43

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*Note.* Descriptive statistics and test-retest reliabilities are based on imputed data set. Averages are based on *r*-to-*z* transformed correlation coefficients.

Maximization Algorithm, it was possible for the predicted values to be negative, which likely increased the variability and lowered the reliability<sup>3</sup>.

Internal consistencies of this measure for each day are displayed in Table 7 for morning and afternoon fatigue scores in the original data set, as values were not imputed at the item-level and therefore internal consistencies could not be calculated for daily imputed fatigue scores. Within the original data set, the internal consistencies were high, with all values over  $\alpha=.95$  for both morning and afternoon subjective fatigue for all three weeks.

#### *Final Questionnaire*

Experimental and control participants completed a final questionnaire at the end of the 3-week period. Participants were asked to indicate from 0-5 the number of weekdays during Weeks 1, 2, and 3 each statement occurred for a total of 10 statements. Directions were altered slightly for experimental participants during Week 2 to remind them to answer based on their experience using the study alarm. Questions pertained to self-regulatory processes engaged during the awakening process each day, whether participants followed directions, feelings towards snoozing and getting up in the morning, and whether snoozing affected close others. One question was also included to assess whether participants remembered missing activities during the day due to snoozing. Two final questions were included to assess the extent to which participation in the study may affect their expected future snooze usage and/or alarm clock choice. These two items were answered on a yes/no scale.

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<sup>3</sup> Test-retest reliabilities for morning and afternoon subjective fatigue scores were also calculated on the original data set and values ranged from  $r = .56-.75$ . Although these internal consistencies are notably higher than those from the imputed data set, the means were not significantly different between the original and imputed data sets.

Table 7

## Internal Consistency of Fatigue Scales from Original Data Set

Day	Morning Subjective Fatigue			Afternoon Subjective Fatigue		
	<i>M</i>	<i>SD</i>	$\alpha$	<i>M</i>	<i>SD</i>	$\alpha$
1	3.17	1.04	.95	2.78	1.03	.95
2	2.82	1.16	.96	2.71	1.16	.96
3	2.86	1.11	.97	2.79	1.13	.96
4	2.74	1.12	.96	2.62	1.14	.96
5	2.79	1.23	.96	2.48	1.08	.96
6	3.01	1.16	.97	2.82	1.06	.95
7	2.86	1.17	.96	2.59	1.06	.95
8	2.93	1.17	.96	2.71	1.16	.96
9	2.90	1.31	.97	2.77	1.78	.96
10	2.92	1.28	.97	2.60	1.16	.96
11	2.90	1.11	.96	2.59	1.10	.96
12	2.93	1.26	.97	2.64	1.34	.96
13	2.85	1.16	.96	2.67	1.19	.96
14	2.77	1.13	.96	2.59	1.04	.95
15	2.85	1.18	.96	2.56	1.08	.96



Descriptive results from this questionnaire are presented in Tables 8 through 10. Tables 8 and 9 display the means and standard deviations of the number of week days per week participants in the experimental and control groups reported engaging in various activities. Participants in both groups reported difficulty getting out of bed in the morning, on average over 3.46 weekdays per week. Experimental participants reported going back to sleep and dozing in and out of sleep more during Weeks 1 and 3 than Week 2, whereas control participants reported falling back asleep and dozing in and out of sleep approximately the same average number of days during each week. The following three items received the lowest reported average frequencies each week for both experimental and control participants: lying in bed thinking of things that needed to be done, engaging in an activity before getting out of bed, and bothering close others with snooze habits.

Future behavior intentions are displayed in Table 10. Over 50% of the experimental participants reported that they would change their snooze habits in the future, but only 35% reported that they would consider using an alarm without a snooze function in the future. Over 50% of the control group reported that they would not change their snooze habits in the future, and exactly 50% reported that they would consider using an alarm without a snooze button in the future. Participants in both the experimental group and control group who reported willingness to use an alarm without a snooze button in the future also reported expecting to change snooze habits in the future ( $r = .46, p < .01$  and  $r = .44, p < .05$  respectively). A copy of this measure may be found in Appendix M.

### *Analysis*

Several steps were taken prior to analysis to assess whether the data could be combined and assessed as originally planned, including assessment of normality, assessment

Table 8

Average Number of Days per Week for Sleeping and Waking Activities after Pressing the Snooze Button (Experimental Group)

	Week 1		Week 2		Week 3	
Item	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
BTS	3.27	1.59	1.12	1.29	2.78	1.75
DZD	2.92	1.73	1.36	1.32	2.47	1.77
LAW	.83	1.26	1.45	1.55	1.13	1.47
ENA	.63	1.28	1.03	1.49	.58	1.21
RES	2.56	1.82	1.26	1.58	2.37	1.82
CHP	2.05	1.74	.77	1.22	1.88	1.73
LFA	1.56	1.42	.77	1.13	1.51	1.50
DIF	3.77	1.42	3.46	1.50	3.72	1.37
PDM	2.09	1.85	1.47	1.50	1.92	1.70
BCO	.19	.76	.26	.76	.27	.91

*Note.* N=78. BTS = back to sleep; DZD = dozed in and out of sleep; LAW = lay awake thinking; ENA = engage in an activity before getting out of bed; RES = regret snoozing; CHP = lay in bed and changed plans; LFA = late for first activity; DIF = found it difficult to get up; PDM = planned to do more before first scheduled activity; BCO = snoozing bothered close others.

Table 9

Average Number of Days per Week for Sleeping and Waking Activities after Pressing the Snooze Button (Control Group)

	Week 1		Week 2		Week 3	
Item	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
BTS	2.59	1.76	2.63	1.70	2.69	1.84
DZD	2.55	1.65	2.72	1.67	2.50	1.72
LAW	.72	1.22	.88	1.31	1.06	1.54
ENA	.50	1.30	.59	1.29	.72	1.39
RES	2.56	1.72	2.78	1.54	2.66	1.58
CHP	1.69	1.64	1.94	1.39	1.66	1.34
LFA	1.16	1.39	1.41	1.24	1.41	1.39
DIF	3.47	1.69	3.63	1.39	3.53	1.55
PDM	2.09	1.99	2.16	1.88	2.16	1.81
BCO	.59	1.27	.78	1.39	.66	1.34

*Note.* N=32. BTS = back to sleep; DZD = dozed in and out of sleep; LAW = lay awake thinking; ENA = engage in an activity before getting out of bed; RES = regret snoozing; CHP = lay in bed and changed plans; LFA = late for first activity; DIF = found it difficult to get up; PDM = planned to do more before first scheduled activity; BCO = snoozing bothered close others.

Table 10

## Percentages of Future Behavior Intentions

Group	Future Behavior			
	FAL		CSH	
	Yes	No	Yes	No
Experimental (n = 78)	34.6	65.4	53.8	46.2
Control (n=32)	50.0	50.0	46.9	53.1

*Note.* FAL = consider using an alarm without a snooze function in the future; CSH = change snooze habits in the future

of gender differences, comparisons of the experimental and control groups, and completing a missing data analysis. These steps are described in turn below.

The skewness and kurtosis of all trait variables were assessed. Skewness ranged from -.64 to .91 and kurtosis from -.83 to 1.52. Similarly, for the variables measured daily and relevant to hypotheses, the skewness ranged from -.87 to 1.9 and kurtosis from -2.04 to 4.9. In a normal distribution, skewness is equal to zero and kurtosis is equal to three (Kendall & Stuart, 1948); however the statistical program employed in analyses for the present study sets the kurtosis equal to zero for a normal distribution. Nonetheless, the values obtained in this study are within acceptable range of what could be expected from a normal distribution, and the frequency plots for each variable did not indicate serious deviations from normality. Given the size of the present sample, skewness and kurtosis are less likely to impact variable distributions (Tabachnick & Fidell, 2001).

Potential differences between men and women on the AIP were investigated before combining these groups in future analyses. An independent groups *t*-test indicated no significant mean difference between men and women ( $t(108) = -.12$ , ns,  $d = -.12$ ) on this measure. Additionally, because of previous findings suggesting that a stronger relationship may exist between the AIP and other measures of procrastination for women than for men (Blunt & Pychyl, 1998; Ferrari & Patel, 2004), correlations between the AIP and other trait measures in this study were explored. Table 11 presents the means and standard deviations for each measure separated by gender and the correlations of each measure with the AIP. Gender differences in the strength of relationship between the AIP and other trait measures occurred on the following four variables: morningness-eveningness, negative affect, impulse control, and perfectionism. Men who scored higher on the AIP reported less perfectionism

Table 11  
Correlations of the Adult Inventory of Procrastination (AIP) with Other Trait Measures Split by Gender

Variables	Men (n = 47)			Women (n=63)		
	<i>M</i>	<i>SD</i>	<i>r</i>	<i>M</i>	<i>SD</i>	<i>r</i>
Procrastination	2.72	.78		2.75	.76	
Performance Approach	4.58	1.02	-.26	4.43	.91	-.06
Mastery Avoidance	3.93	.97	-.17	4.20	.79	-.10
Mastery Approach	4.73	.81	-.15	4.50	.77	-.22
Performance Avoidance	4.23	1.10	-.03	4.58	.96	.07
Overall Fatigue	3.14	.85	.51**	3.25	.99	.43**
Mental Fatigue	3.31	.85	.42**	2.98	1.09	.42**
Physical Fatigue	2.85	1.19	.48**	3.40	1.08	.36**
Morningness-Eveningness	2.11	.37	<b>-.27</b>	2.26	.45	<b>-.37**</b>
Positive Affect	5.49	.77	-.36*	5.17	1.03	-.29*
Negative Affect	2.65	.99	<b>.41**</b>	2.95	.94	<b>.20</b>
Sleep Disturbance	2.37	.58	-.04	2.49	.80	-.01
Conscientiousness	4.18	.71	-.68**	4.34	.71	-.53**
Impulse Control	4.10	.77	<b>-.40**</b>	4.10	.63	<b>-.17</b>
Extraversion	3.88	.97	-.10	3.68	.96	-.09
Neuroticism	2.56	.68	.43**	2.90	.88	.24**
Resourcefulness	4.58	.72	-.38**	4.13	.68	-.36*
Self-Regulation/ Self-Control	3.97	.73	-.65**	3.77	.68	-.69**
Perfectionism	4.07	.74	<b>-.30*</b>	4.19	.87	<b>-.20</b>
Curiosity	4.35	.63	-.13	4.32	.65	.12
Anxiety	3.30	.80	.34*	3.77	.81	.29*

*Note.* Correlations in bold indicate differences between men and women.

\*\* p<.01. \* p<.05 .

and impulse control, and greater negative affect. Women who scored higher on the AIP reported greater tendency towards eveningness. Each gender displayed the same trend in these correlations, but the strength of the relationship varied between men and women.

Several sets of independent groups *t*-tests were conducted to evaluate whether differences exist between experimental and control groups both within and across the three study sessions on trait variables, including procrastination, self-regulation, fatigue, and on variables reported on daily questionnaires, including average nap length, sleep time, and snooze time for each week. First, experimental and control participants were compared within conditions across the three sessions. There were no significant trait differences in the either group three Sessions. Regarding variables measured daily, experimental participants in Session 2 reported greater nap length during Week 1 than participants in Session 1 ( $t(49) = 2.99, p < .01, d = .85$ ) and in Session 3 ( $t(50) = 3.31, p < .01, d = .94$ ). Similarly, control participants in Session 2 reported greater nap length during Week 1 than participants in Session 1 ( $t(48) = -2.40, p < .05, d = .69$ ). Experimental participants in Session 2 reported longer time spent sleeping in Week 1 than participants in Session 3 ( $t(50) = -2.42, p < .05, d = .68$ ). There were no significant differences for either group when snooze time was compared across the sessions. Taken together, these results suggest that Session 2, which occurred in October, may have occurred at a time in the semester during which participants slept and/or napped more. Midterms frequently occur in October, which may be related to longer nap time and more sleep during some weeks than others.

Second, experimental and control participants were compared within each session. Snooze time during Week 2 was significantly less for the experimental group than the control group during Session 2 ( $t(31) = -2.45, p < .05, d = .88$ ), however, minimizing snooze time

during Week 2 was part of the instructions given to experimental participants. No significant mean differences were found on any of the other variables when comparing experimental and control participants during Sessions 1, 2, or 3. These findings suggest that, although experimental participants in Session 2 may have demonstrated significantly different nap length and sleep time compared to experimental participants in other sessions, these values were not significantly different from the control group during that Session. These findings provide further support for the notion that Session 2 occurred during a busy time in the semester.

Finally, control and experimental participants across all sessions were compared to one another. No significant mean differences were found between groups for any of the trait or daily variables. Taken together, these comparisons suggest that it is reasonable to collapse groups from each session into overall experimental and control groups, although the potential differences between Session 2 and the other two sessions will be considered when conducting analyses.

Even though efforts were made to remind and incent participants to complete each daily questionnaire, 7.23% of the online questionnaires were missing. Recently, researchers in various fields of psychology have been urging authors not only to acknowledge missing data and take adequate statistical steps to handle it, but also to report in detail the strategies used (Jelicic, Phelps, & Lerner, 2009; Schlomer, Bauman, & Card, 2010). Missing values were imputed using the Expectation-Maximization algorithm (EM algorithm; Dempster, Laird, & Rubin, 1977; Little & Rubin, 1989; Moon, 1996; Roth, 1994), which is an iterative regression technique for predicting missing values based on observed values. Details of the imputation are described in the next section regarding statistical analyses.



## CHAPTER 3

### RESULTS

This chapter is divided into several sections in order to clearly present the way in which the data were analyzed. First, I describe the missing data procedures followed in order to impute missing values. Next, I distinguish between primary and secondary analyses. I then describe the primary analyses in detail, and conclude this section with a description of exploratory analyses which were conducted to further assess and support the primary analyses.

#### *Missing Data Analysis*

The EM algorithm, developed by Dempster, Laird, and Rubin (1977) is a process through which missing data values are estimated. Two steps are taken when the EM algorithm is applied: the expectation step followed by the maximization step. During the expectation step, the expected value of the missing data point is estimated using the current parameter estimate from observed data. Next, the maximization step occurs, during which new parameters are estimated using both the original observed data and the estimated expected values of missing data. The process iterates until the parameter estimates converge and predicted values are provided for missing data points (Moon, 1996).

Important distinctions may be drawn between different patterns of missing data (Little & Rubin, 1989). Missing data may be missing completely at random (MCAR), missing at random (MAR) or not missing at random (NMAR). Data which are MCAR are missing in a truly random fashion that is unrelated to observed or missing variables in the data set. MAR occurs when missing values depend on the value of an observed variable, but are MCAR within any level of that observed variable. NMAR is the most difficult type of

missing data to contend with, as data which are NMAR are missing in a way that is directly related to relevant variables. Included within the output of the missing values analysis is an assessment of whether the missing values are MCAR or not. Significance at the .05-level or below indicates that it is plausible that data are not MCAR.

#### *Missing Data Imputation Procedures*

Several considerations were made when imputing missing values for the current data set, including which variables to include in the EM Algorithm, how to treat values from early and late questionnaires, and whether the imputed data set differed significantly from the original data set. Each of these considerations is described in turn below.

*Variables included in the algorithm.* Independent variables in hypotheses that were relevant to data with missing values were excluded to avoid replication of any direct relationship between observed independent and dependent variables for the missing values. Because variables included in the EM Algorithm are used to predict missing values of other variables, any relationship between observed values would be replicated within the values predicted for missing values. As a result, variables used in the algorithm will likely display a relationship with variables which displayed missing values, and any relationship detected in hypothesis testing could be due to the actual relationship between the variables or the fact that a perhaps trivial relationship was replicated when imputing missing values. The following variables serve as independent variables in the current study and were therefore excluded from all missing values analyses: AIP, KSQ, PA, NA, MEQ, MSF, and MSS. All other trait variables were included in missing values analyses.

A total of fourteen different variables had missing values over the 3-week study period, including 7 from the morning questionnaire, 5 from the afternoon questionnaire, and

2 from the evening questionnaire. Variables were divided into those that were directly relevant to hypotheses and those that were not. The relevant variables included sleep time, snooze time, morning fatigue, and afternoon fatigue. Because snooze time serves as predictor of morning fatigue in Hypothesis 2, two separate analyses were conducted to impute missing values on these four variables. The first imputation included sleep time, morning fatigue, and afternoon fatigue; and the second imputation included sleep time and snooze time. Because these analyses resulted in two different estimates of sleep time, an average of these two estimates was used going forward. Finally, one missing values analysis was conducted using imputed snooze time, fatigue, and average sleep time to impute missing values on other variables such as the time at which participants went to sleep, set their alarms, awoke, and got out of bed, nap length, and the amount of time spent engaging in an activity before getting out of bed.

*Treating values from early and late questionnaires.* Because participants were able to complete questionnaires outside the designated time frames, it was important to consider whether values from on-time questionnaires differed from those in questionnaires completed early and late. This consideration was especially important for state fatigue levels, as state fatigue is expected to fluctuate over the course of the day. To explore these potential differences, all fatigue scores which did not come from on-time questionnaires were imputed. The analysis did include values from late, early, and on-time questionnaires that were relevant to sleeping and waking habits, but only fatigue values from the on-time questionnaires.

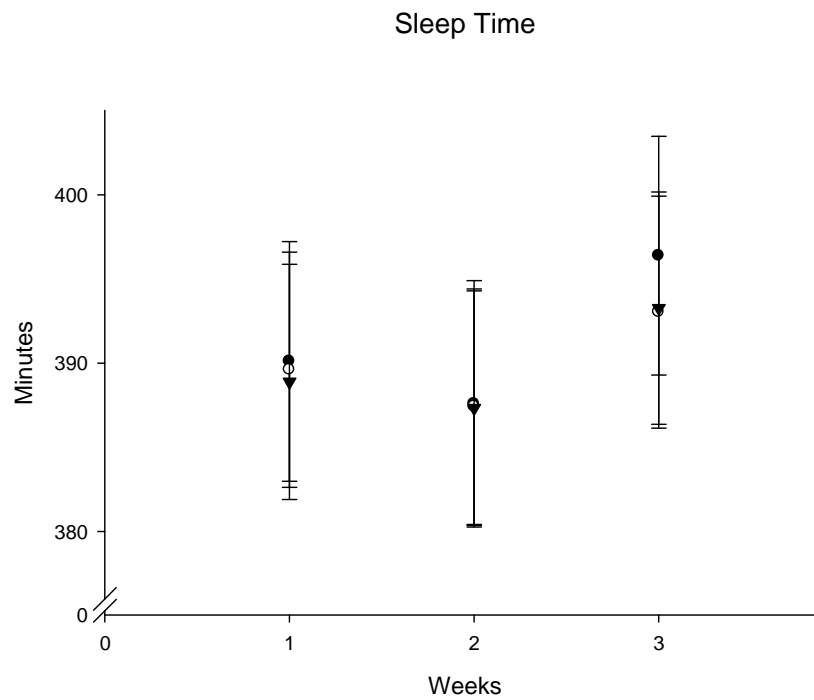
Entries pertaining to sleeping and waking habits that came from questionnaires out of the designated time frame were used in this analysis rather than excluding all information

from late and early questionnaires for two reasons. First, it is likely that participants are relatively accurate in recalling times (e.g., time they went to bed, time they woke up and got out of bed, time of first activity). Any deviances in accuracy of these values are likely minor compared to potential deviances when imputed with a missing values analysis. Second, excluding these values created a large amount of data to be imputed (over 30%), which is not desirable.

*Comparing data sets with different missing values procedures.* Comparisons were made between several data sets to assess whether there were differences between them on variables with values which were imputed different ways. The original data set with missing values (using information from all completed questionnaires), the data set with missing values imputed (using information from all completed questionnaires), and the data set with missing values imputed for fatigue scores from late, early, and missing questionnaires (using all other information from completed questionnaires) were compared. The daily and weekly means and standard errors were compared on the following variables: sleep time, snooze time, morning subjective fatigue, afternoon subjective fatigue, time spent engaging in an activity before getting out of bed, and nap length.

Figures 9 through 14 show the results of these comparisons at the mean level for weekly sleep time, snooze time, morning and afternoon fatigue, time spent engaging in an activity before getting out of bed, and nap time. Figure 15 shows the comparisons for daily snooze times. There were no significant differences (i.e., more than one standard error difference) between data sets on any of the weekly means except in nap length. The means for all imputed data sets were significantly lower than those for the original data set for nap length, and the imputed values were not significantly different from one another. One

Figure 9



*Note.* Error bars represent standard error.

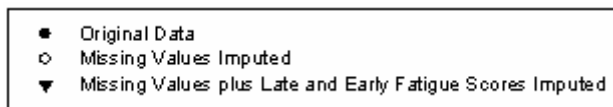
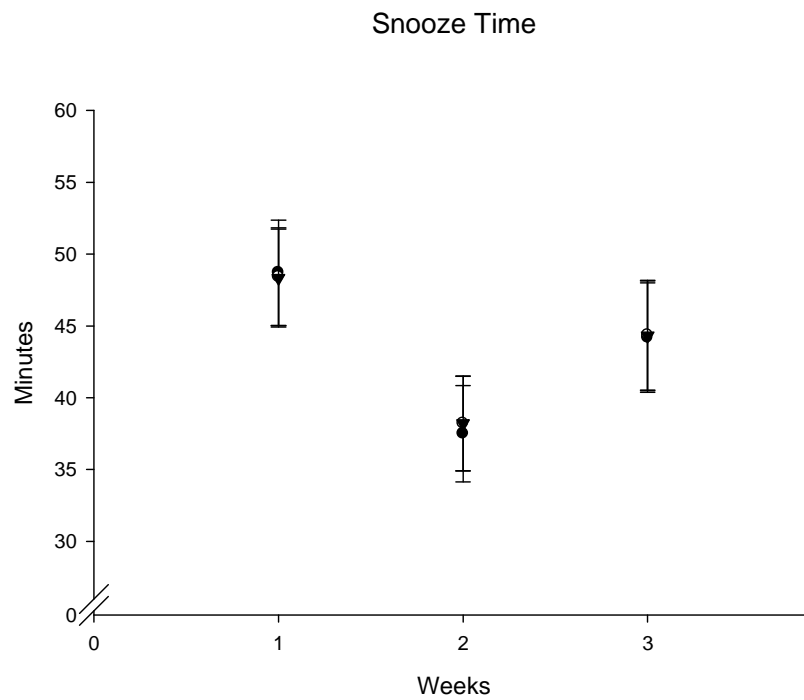


Figure 10



*Note.* Error bars represent standard error.

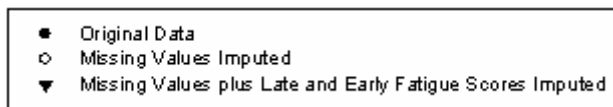
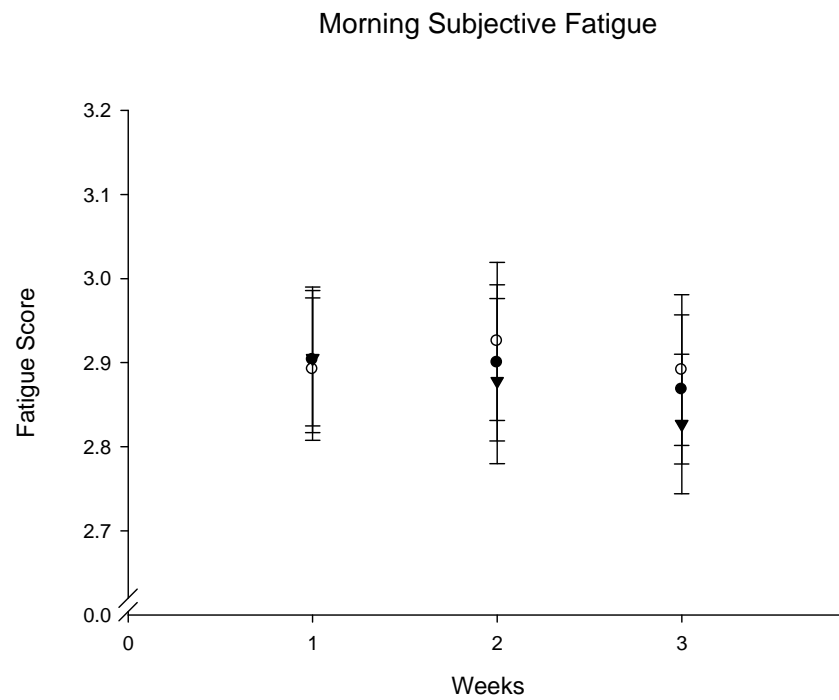


Figure 11



*Note.* Error bars represent standard error.

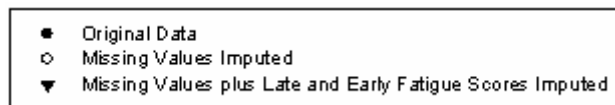
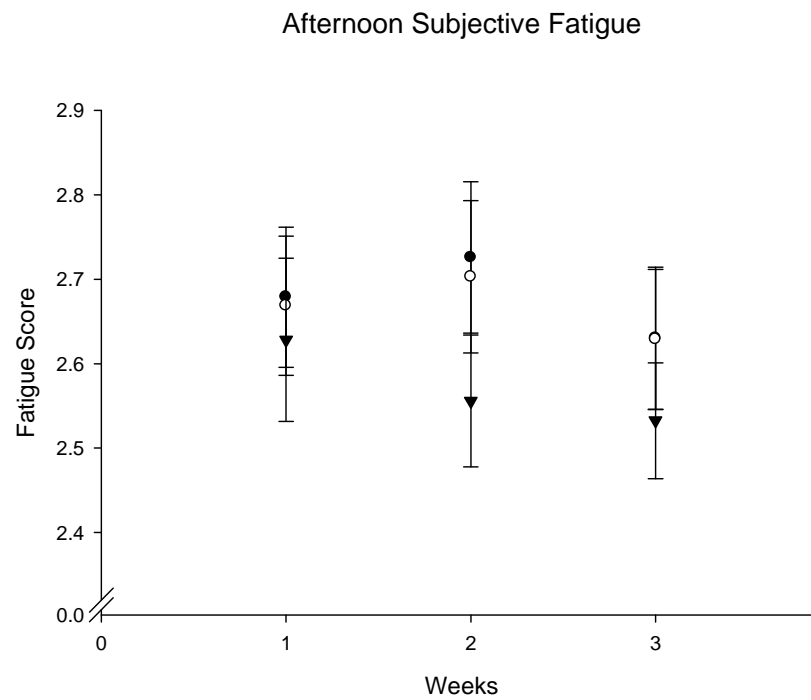


Figure 12



*Note.* Error bars represent standard error.

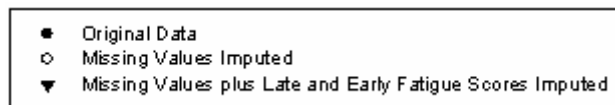
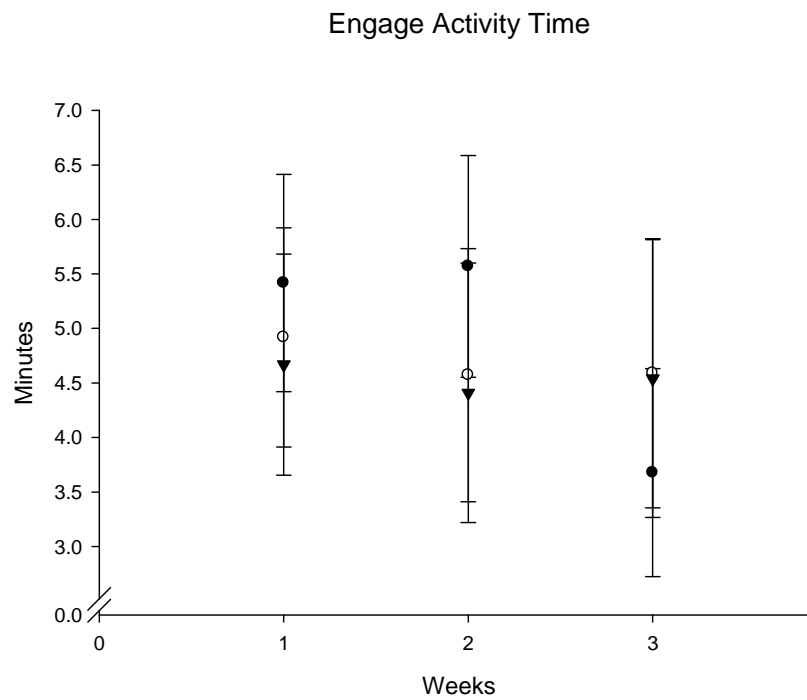




Figure 13



*Note.* Error bars represent standard error.

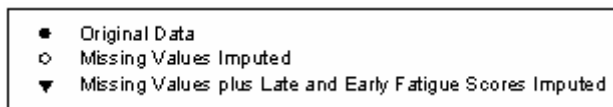
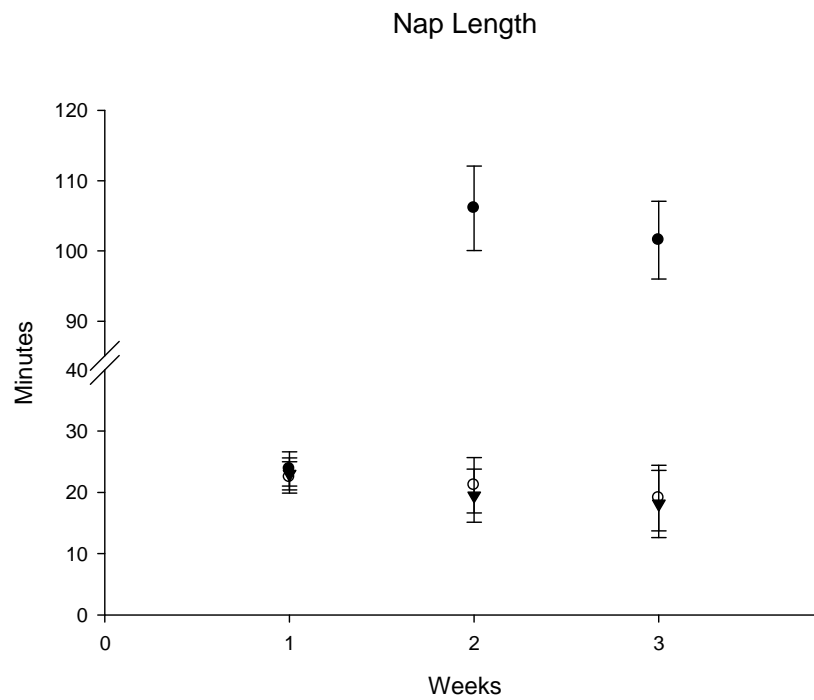


Figure 14



*Note.* Error bars represent standard error.

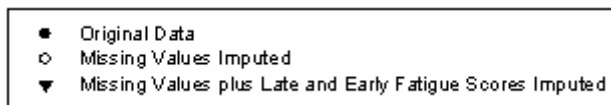
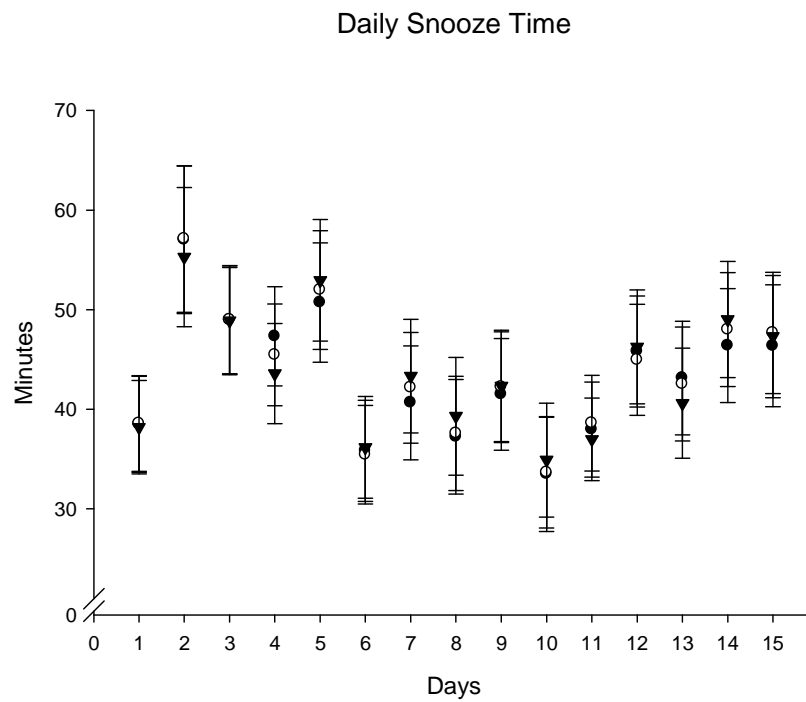
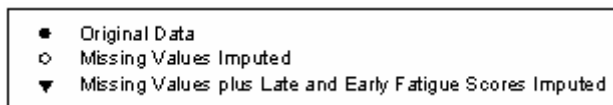


Figure 15



*Note.* Error bars represent standard error.



possible reason for this finding may be that many reported nap lengths were either zero or a relatively larger length of time. Fitting a regression line, which would be used to predict missing values, to these observed values could easily result in negative predicted values. These negative values may have brought the means down further than they were able to go in the original data set in which the lowest reported nap length was zero minutes. Even though significant differences were not found between the imputed and original data sets, future analyses were conducted using the data set which imputed late and early fatigue scores in addition to all missing values.

Regarding the lack of differences in state fatigue values between these data sets, participants were instructed to complete the fatigue scales on late questionnaires in a retrospective manner, recalling how they felt during the designated time frame and reporting those feelings rather than current feelings. If participants were able to do this successfully, values imputed for missing fatigue scores and values imputed for missing, on-time, and late fatigue scores would not be expected to differ greatly. Based on the similarities between these imputed data sets, it appears that participants were either able to respond with feelings of state fatigue relevant to the correct time frame even on questionnaires completed outside that time frame, or state fatigue did not fluctuate greatly over the course of the day.

Little's MCAR test was not significant ( $p > .05$ ) for any of the imputed data sets, suggesting that the data were MCAR. Correlations were computed between all trait variables and the number of missing questionnaires for the morning, afternoon, and evening time points, as well as for total questionnaire missingness. Table 12 shows the correlations that reached significance. Related variables include gender, age, impulse control, conscientiousness, extraversion, and mid-sleep time point on free days. These results suggest

that although the number of missed questionnaires may be related to these demographic and trait variables, the pattern of missing data was not contingent on participants' scores on these variables.

Table 12

Correlates of Number of Morning, Afternoon, Evening, and Total Missing Questionnaires with Trait Variables

Variable	Questionnaires			
	Morning	Afternoon	Evening	Total
Gender	-.21*	-.20*	-.26*	-.26*
Age	-.20*	-.14	-.03	-.14
Impulse Control	-.20*	.06	-.04	-.04
Conscientiousness	-.24*	-.19*	-.09	-.20*
Extraversion	.21*	.22*	.22*	.25**
MSF	.16	.17	.25**	.22*

Note: Gender coded as 1 (men) and 2 (women). MSF = mid-sleep time-point on free days.  
 \*  $p < .05$  . \*\*  $p < .01$ .

### *Primary and Secondary Analyses*

Given the number of hypotheses included in the proposed study, they were divided into primary and secondary hypotheses to allow for Type I error control without a large decrease in power. Hypotheses 2, 3, and 4 served as primary hypotheses and the remaining 13 served as secondary hypotheses. Because these primary hypotheses were assessed through two separate analyses, the alpha-value of .05 was divided by 2 and each hypothesis was tested at the .025-level. Further, two paired  $t$ -tests were conducted to assess Hypotheses 3 and 4, and alpha was further corrected when assessing the results of each  $t$ -test.

Secondary hypotheses which pertained to relationships between traits are presented and discussed in Appendix N. Support was found for six of the eight hypotheses regarding trait relationships. In addition, exploratory hypotheses regarding afternoon subjective fatigue and goal orientation may be found in Appendix O. These analyses were conducted as proposed but did not yield findings relevant to the primary hypotheses.

### *Primary Analyses*

Primary hypotheses and several secondary hypotheses which are relevant to snooze time and/or subjective morning fatigue will be presented below. This separation is implemented in order to focus on the primary hypotheses and other findings relevant to procrastination, fatigue, and self-regulation. Zero-order correlations were computed between all trait measures and can be found in Table 13. Hypotheses were tested using correlational analyses, paired *t*-tests, and hierarchical regression analyses, and are described in detail below in order of hypothesis.

Several hierarchical regression analyses were conducted to assess variables that might predict snooze time and subjective morning fatigue after controlling for the number of hours slept. Hypothesis 1 stated that trait procrastination would be positively associated with snooze time during Weeks 1 and 3. Experimental and control groups were examined together, and morning fatigue scores from Week 1 were averaged for each participant to represent a baseline morning fatigue score. For the first analysis, the average amount of sleep time (in minutes) during Week 1 was entered in the first step, and mean trait procrastination was entered next. Average minutes slept accounted for a significant amount of variance in snooze time ( $R^2 = .33, p < .01$ ) and trait procrastination accounted for a small but significant amount of variance beyond the amount of time slept ( $\Delta R^2 = .03, p < .05$ ).

Table 13 Summary of Intercorrelations between All Trait Measures

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. AIP																						
2. GPAP	-.15																					
3. GMA	-.13	.10																				
4. GMAP	-.19	.19	.44**																			
5. GPA	.02	.13	.23*	.02																		
6. CFS	.46**	-.06	.19	-.04	.08																	
7. CFSP	.41**	.05	.18	-.01	.10	.93**																
8. CFSM	.41**	-.20*	.15	-.07	.03	.84**	.59**															
9. MEQ	-.32**	-.09	.19	.17	.07	-.24*	-.26**	-.15														
10. PA	-.31**	.07	-.05	.22*	-.03	-.36**	-.40**	-.21*	.22*													
11. NA	.29**	.05	.27**	.01	.26**	.52**	.48**	.43**	-.02	-.28**												
12. KSQ	-.02	-.08	.07	.07	.12	.17	.19*	.09	.13	-.11	.07											
13. CON	-.59**	.22*	.27**	.19*	.01	-.41**	-.36**	-.38**	.29**	.38**	-.19	-.12										
14. IMP	-.28**	-.04	-.06	-.01	-.13	-.29**	-.24*	.29**	.04	.02	-.41**	-.13	.17									
15. EXT	-.09	-.12	-.16	-.20*	-.02	-.18	-.24*	-.03	-.10	.41**	-.21*	-.03	.07	-.31**								
16. NEURO	.36**	.03	.22*	-.07	.16	.52**	.47**	.46**	.00	-.52**	.69**	.09	-.18	-.41**	-.28**							
17. RSC	-.36**	-.03	-.15	.17	-.12	-.40**	-.39**	-.32**	.05	.62**	-.44**	-.10	.32**	.18	.47**	-.63**						
18. SRSC	-.66**	.15	.11	.22*	.03	-.36**	-.36**	-.27**	.29**	.41**	-.23*	-.10	.52**	.32**	-.02	-.28**	.41**					
19. PERF	-.24*	.36**	.41**	.26**	.20*	.09	.12	.03	.18	.15	.22*	.07	.58**	-.15	-.08	.29**	-.02	.21*				
20. CUR	.01	-.09	-.13	.05	-.11	-.30**	-.35**	-.15	.07	.55**	-.37**	.05	.20*	.02	.40**	-.38**	.40**	.01	.03			
21. ANX	.44**	.11	.10	-.13	.07	.55**	.58**	.35**	-.29**	-.52**	.51**	.07	-.27**	-.42**	-.24*	.65**	-.64**	-.53**	.08	-.36**		
22. MSS	.19*	-.03	.00	.05	-.02	.16	.18	.10	-.41**	.21*	.08	-.22*	-.23*	-.11	.06	.05	.04	-.18	-.10	-.21*	.19*	
23. MSF	.30**	-.03	-.10	.00	-.04	.12	.12	.08	-.50**	-.02	.00	-.07	-.23*	.05	.02	-.06	.08	-.16	-.20	-.02	.10	.43**

*Note.* AIP = Adult Inventory of Procrastination; GPAP = Achievement Goal Orientation Performance Approach; GMA= Achievement Goal Orientation Mastery Avoidance; GMAP= Achievement Goal Orientation Mastery Approach; GPA = Achievement Goal Orientation Performance Avoid; CFS = Chalder Fatigue Scale; CFSP = Chalder Physical Fatigue Subscale; CFSM = Chalder Mental Fatigue Subscale; MEQ = Morningness Eveningness Questionnaire; PA = Positive Affect; NA = Negative Affect; KSQ = Karolinska Sleep Disturbance Questionnaire; CON = Conscientiousness; IMP = Impulse Control; EXT = Extraversion; NEURO = Neuroticism; RSC = Resourcefulness; SRSC = Self-Regulation/Self-Control; PERF = Perfectionism; CUR = Curiosity; ANX = Anxiety; MSS = Mid-Sleep Time-point on School Days; MSF = Mid-Sleep Time-Point on Free Days.

\* $p < .05$ . \*\* $p < .01$ .

Similar steps were followed in the second analysis for Week 3. Average minutes slept accounted for a significant amount of variance in snooze time ( $R^2 = .34, p < .01$ ) and trait procrastination added significant incremental prediction ( $R^2 = .02, p < .05$ ). It should be noted that average sleep time was negatively related to snooze time, such that the greater the average sleep time, the less average morning snooze time, whereas procrastination was positively related, with higher trait procrastination associated with longer snooze time. Table 14 displays the beta-weights and changes in  $R^2$  associated with these hierarchical regression analyses. These findings provide support for Hypothesis 1, in that trait procrastination was a significant predictor of morning snooze time during Weeks 1 and 3, after accounting for the number of hours slept. It should be noted that the relationship between trait procrastination and self-reported average snooze time was not significant ( $r = .11, ns$ ), indicating that a different relationship between trait procrastination and behavior delay emerges when using self-reports of behavior versus aggregated measures of behavior.

To test the second hypothesis, a hierarchical regression analysis was conducted to assess whether snooze time would contribute unique prediction to morning fatigue scores above and beyond the amount of time slept. As this hypothesis was a primary hypothesis, it was tested with an alpha-level of .025. Support was not provided for Hypothesis 2, as snooze time was not a significant predictor of morning fatigue, after accounting for the number of hours slept during any week of the study. These findings were similar when examining experimental and control groups separately and all participants combined. Table 15 displays the beta-weights and changes in  $R^2$  associated



Table 14

## Trait Procrastination as Predictor of Snooze Time

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.33**	1, 108	-.58**
	Minutes Slept			
	Step 2	.03*	2, 107	.18*
	Procrastination			
3	Total $R^2$	.36**		
	Step 1	.34**	1, 108	-.58**
	Minutes Slept			
	Step 2	.02*	2, 107	.16*
	Procrastination			
	Total $R^2$	.36**		

Note. N = 110.

\*  $p < .05$ . \*\* $p < .01$

Table 15

## Snooze Time as Predictor of Subjective Morning Fatigue

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.04	1, 108	-.18
	Minutes Slept			
	Step 2	.00	2, 107	.03
	Snooze Time			
2	Total $R^2$	.04		
	Step 1	.07*	1, 108	-.27*
	Minutes Slept			
	Step 2	.00	2, 107	-.04
3	Snooze Time			
	Total $R^2$	.07*		
	Step 1	.11**	1, 108	-.39**
	Minutes Slept			
	Step 2	.01	2, 107	-.11
	Snooze Time			
	Total $R^2$	.12**		

Note. N = 110.

\*  $p < .05$ . \*\* $p < .01$

with these hierarchical regression analyses for all participants. Average sleep time was a significant predictor of morning overall fatigue in Weeks 2 and 3, such that the more time slept, the less morning fatigue reported; however, snooze time did not add unique prediction to morning fatigue beyond time slept. To explore this hypothesis another way, partial correlations were conducted for each day between snooze time and subjective morning fatigue once the amount of time slept was accounted for. These correlations were transformed using Fisher's *r*-to-*z* transformation, then averaged within each week and transformed back into correlations. However, the correlations between morning fatigue and snooze time were all close to zero, suggesting no relationship between snooze time and morning fatigue.

To test Hypotheses 3 and 4, paired *t*-tests were conducted to assess whether morning fatigue scores were different across each week of the study. Differences were expected among the experimental group, such that mean morning fatigue would be lower during Week 2 than Weeks 1 and 3. As these were two of the three primary hypotheses in the current study, an alpha-value of .025 was divided by 2 to yield an alpha of .0125 with which these hypotheses would be tested. Mean morning fatigue scores were aggregated during each week and compared. Significant differences were not detected between mean morning subjective fatigue scores for either comparison. As a result, Hypotheses 3 and 4 were not supported.

As mentioned previously, snooze time was only significantly lower for the experimental group during Session 2 than for experimental groups in other Sessions. To explore whether experimental groups would display different mean fatigue scores within their respective Sessions, they were split by session and fatigue scores were assessed

between Weeks within each Session; however, no mean differences were found between Week 2 and Weeks 1 and 3 within any of the 3 Sessions. These hypotheses were explored further in exploratory analyses, and a description of related findings may be found below under the Exploratory Analyses section.

Hypothesis 8 stated that baseline morning fatigue scores would be related to the global scale of sleep disturbance. Hypothesis 8 was supported, in that baseline morning fatigue scores were positively related to the KSQ scale of sleep disturbance ( $r = .21$ ,  $p < .05$ ), indicating that greater morning fatigue during Week 1 was significantly related to reports of sleep disturbance. Subjective morning fatigue during Week 1 was also negatively correlated with the MEQ ( $r = -.30$ ,  $p < .01$ ), providing support for Hypothesis 10, which stated that baseline subjective morning fatigue would be related to higher ratings of trait eveningness. As hypothesized, participants who reported higher levels of subjective morning fatigue during Week 1 also scored lower on the MEQ, indicating greater preference towards eveningness than morningness.

Hypotheses 14 and 16 were explored through several regression analyses assessing whether trait positive and negative affect would be significant predictors of morning fatigue scores. Experimental and control groups were combined for these analysis. Support was provided for both hypotheses, in that PA and NA were significant predictors of morning fatigue scores during all 3 Weeks after controlling for amount of time slept. Table 16 displays beta-weights and changes in  $R^2$  associated with these analyses. An opposite pattern was found for the prediction from PA than the prediction from NA, such that greater levels of reported PA predicted lower levels of morning fatigue, whereas greater levels of reported NA predicted higher levels of morning fatigue.

Table 16

## Positive and Negative Affect as Predictors of Subjective Morning Fatigue

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.04*	1, 108	-.19*
	Minutes Slept			
	Step 2	.14**	2, 107	-.37**
	Positive Affect			
	Total $R^2$	.18**		
1	Step 1	.04	1, 108	-.11
	Minutes Slept			
	Step 2	.13**	2, 107	.38**
	Negative Affect			
	Total $R^2$	.17**		
2	Step 1	.07*	1, 108	-.23*
	Minutes Slept			
	Step 2	.16**	2, 107	-.40**
	Positive Affect			
	Total $R^2$	.23**		
2	Step 1	.07*	1, 108	-.19*
	Minutes Slept			
	Step 2	.14**	2, 107	.38**
	Negative Affect			
	Total $R^2$	.21**		
3	Step 1	.11**	1, 108	-.31**
	Minutes Slept			
	Step 2	.03*	2, 107	-.19*
	Positive Affect			
	Total $R^2$	.14**		
3	Step 1	.11*	1, 108	-.29*
	Minutes Slept			
	Step 2	.05*	2, 107	.22*
	Negative Affect			
	Total $R^2$	.16*		

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Note. N = 110

\*  $p < .05$ . \*\* $p < .01$

### Exploratory Analyses

#### Further Exploration of Primary Hypotheses

Given that fatigue scores were expected to be lower during Week 2 based on the restriction of snooze time during that week, snooze time was further explored to assess whether or not participants followed instructions. For experimental participants across all sessions, snooze time was significantly lower during Week 2 than Week 1 ( $t(77) = 2.67, p < .01, d = .60$ ), but not Week 3 ( $t(77) = -1.77, ns, d = .40$ ). These differences were not present for the control group. However, it may be that one Session is driving the overall difference in snooze times across weeks. To explore this possibility, experimental participants were then compared within each Session. Table 17 shows that significant differences in snooze time between weeks exist within both Sessions 1 and 2, suggesting that Session 2 is not completely driving the difference in snooze time.

Table 17

Contrast of Snooze Times between Weeks 1 and 2, 2 and 3, for Experimental Group by Session

Session	Week 1		Week 2		Week 3		<i>t</i>	<i>df</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
1 <sup>a</sup>	50.73	34.70	39.83	39.14	55.01	46.96	2.05*	25	.66
			39.83	38.14			-2.99*	25	.80
2 <sup>b</sup>	47.67	31.14	33.28	28.99	38.72	30.63	2.48*	24	1.07
			33.28	28.99			-1.13	24	.41
3 <sup>c</sup>	42.87	35.82	40.20	34.37	38.61	33.28	.41	26	.17
			40.20	34.37			.21	26	.11

Note. <sup>a</sup> N=26; <sup>b</sup> N=25; <sup>c</sup> N=27

\*  $p < .05$  (1-tailed)

However, there were no significant differences within Session 3. The lack of significant difference in snooze times for this Session could be attributable to one of several explanations. It may be that, on average, these participants may not have fully followed study instructions to minimize snooze time during Week 2. Alternatively, the average daily snooze time during Week 1 for this Session is somewhat lower than that of Sessions 1 or 2 during Week 1, suggesting that participants in this Session snoozed less to begin with. As a result, the lack of significant difference in snooze times during Week 2 compared to Week 1 could be because snooze time started at a lower point to begin with.

Inspection of the combined experimental group from Sessions 1 and 2 further indicated that snooze time was lower during Week 2 than Week 1 ( $t(50) = 3.24, p < .01, d = .84$ ) and Week 3 ( $t(50) = -2.95, p < .01, d = .62$ ). However, subjective morning fatigue did not follow the same trend, and was relatively similar across the 3-week period for the experimental group in these two Sessions. Further analyses included only individuals whose snooze time decreased from Week 1 to Week 2, which included 51 of the 78 experimental participants in all 3 Sessions; however, subjective morning fatigue was not lower during Week 2 for these participants.

Taking a different perspective, participants whose fatigue did decrease during Week 2 of the study, as compared to Week 1, were examined more closely. These individuals were identified by visually comparing mean subjective morning fatigue from Week 2 to Week 1. Anyone whose fatigue stayed the same or was higher during Week 2 was not included in this analysis. Paired t-tests indicate that these participants did snooze for less time during Week 2 than Week 1 ( $t(49) = 2.80, p < .01, d = .60$ ) and Week 3 ( $t(49) = -2.66, p < .05, d = .56$ ). However, comparisons of their mean fatigue scores indicated no

significant differences during Week 2 compared to Week 1 or Week 3, and snooze time did not emerge as a significant predictor of subjective morning fatigue for these participants, after controlling for amount of time slept. These participants did not report different sleep times, nap lengths, or time spent engaging in an activity before getting out of bed during Week 2 compared to Weeks 1 or 3. Although subjective morning fatigue decreased from Week 1 to Week 2 for these participants, and snooze time decreased as well, the change in fatigue was not significant. This finding suggests that there may be individual differences in the level of subjective morning fatigue scores which increase the variability of responses such that, when averaged across, the weekly differences in fatigue tend to dissipate.

Further analyses included *adjusted snooze time*, which accounted for the time spent engaging in an activity after the first alarm ring and before getting out of bed. Adjusted snooze time was then averaged over each week. Based on these results, adjusted snooze time was also lower during Week 2 than Week 1 ( $t(77) = 2.27, p < .05, d = .55$ ) but not Week 3 ( $t(77) = -1.4, ns, d = .33$ ) for all experimental participants. This finding suggests that after accounting for the amount of time participants spent engaging in activities before getting out of bed, snooze time was still significantly less during Week 2 than Week 1. Yet, fatigue scores did not change.

#### *Further Exploration of Primary Hypotheses through Reported Self-Regulatory Processes*

As the primary hypotheses predicted that subjective morning fatigue would decrease when snooze time decreased due to the decreased engagement in self-regulatory processes, these processes were explored. Although self-regulation was not directly assessed each day, at the end of the 3-week period, participants retrospectively reported

the number of days they engaged in self-regulatory processes when getting out of bed each week. Three questions on the Final Questionnaire assessed self-regulation, including the number of days participants lay awake after pressing the snooze button thinking of things they needed to do, changed plans for the morning after pressing the snooze button, and planned to do more things before their first scheduled activities than they actually accomplished.

Paired *t*-tests indicate that experimental participants reported laying awake thinking of things they needed to do on more days during Week 2 than Week 1 ( $t(77) = -3.53, p < .05, d = .99$ ) and Week 3 ( $t(77) = 1.75, p < .05$ , one-tailed,  $d = .47$ ). They reported changing their morning plans on fewer days during Week 2 than Week 1 ( $t(77) = 6.47, p < .01, d = 1.93$ ) and Week 3 ( $t(77) = -6.21, p < .01, d = 1.68$ ). Finally, participants reported planning to do more before their first scheduled activities on fewer days during Week 2 than Week 1 ( $t(77) = 2.9, p < .01, d = .83$ ) and Week 3 ( $t(77) = -2.25, p < .05, d = .63$ ). These differences were not present in the reports of the control group. These findings suggest that, for the experimental group, two of the assessed self-regulatory processes were not utilized as often during Week 2 as they were during Weeks 1 and 3, and one self-regulatory process was utilized more often in Week 2 than the other 2 weeks.

Additionally, experimental participants reported falling back asleep after the first alarm ring on fewer days during Week 2 than Week 1 ( $t(77) = 10.16, p < .01, d = 3.34$ ) and Week 3 ( $t(77) = 7.30, p < .01, d = 2.44$ ). Similarly, these participants reported dozing in and out of sleep on fewer days during Week 2 than Week 1 ( $t(77) = 6.52, p < .01, d = 2.29$ ) but on and Week 3 ( $t(77) = 4.69, p < .01, d = 1.61$ ). These differences were also not



present in the control group. These results are consistent with the lower snooze times reported above during Week 2 for experimental but not control participants.

Because the final questionnaire was retrospective, it may be considered as a reflection of a manipulation check rather than of accurate reports of processes and activities engaged in each week. To assess whether participants' reports on the Final Questionnaire were consistent with data collected from the Daily Questionnaires, two correlations were conducted. The first correlation assessed the relationship between the number of days participants reported engaging in activities before getting out of bed on the Final Questionnaire and their daily reports. Significant correlations were found between retrospective reports and daily reports during Weeks 1 ( $r = -.39, p < .01$ ) and 2 ( $r = .35, p < .01$ ), but not Week 3 ( $r = .04, ns$ ). However, the negative correlation suggests an inverse relationship between what participants retrospectively reported and what they reported each day. This relationship runs contrary to the positive correlation found during Week 2. The second correlation assessed the relationship between the number of days participants reported being late to or missing their first scheduled activities of the day on the Final Questionnaire and their daily reports. Results indicate nonsignificant relationships for all 3 Weeks. These findings suggest that participants' memories pertaining to the questions asked on the Final Questionnaire were not accurate the majority of the time, or were not in the expected direction, when compared to data collected each day.

These supplemental analyses provide evidence to suggest that experimental participants seemed to follow directions to use the study alarm and snooze less during Week 2; however, they did not report lower feelings of subjective morning fatigue during

Week 2 compared to Weeks 1 and 3. These participants did not report different nap times or sleep times across the three weeks of the study, suggesting that subjective morning fatigue was not influenced by these other variables. Participants also reported engaging in several self-regulation processes on fewer days during Week 2; however, these retrospective reports must be interpreted with caution, as the assessment of participants' recall suggests an incompatibility between the self-reported behaviors and actual behaviors.

#### *Further Exploration of the Relationship between Trait Procrastination and State Fatigue*

Given that previous studies have found a relationship between procrastination and fatigue at the trait level (Gropel & Steel, 2008), but results reported above do not support a relationship between behavioral procrastination and state fatigue, steps were taken to explore whether perhaps trait procrastination was related to state fatigue. Both experimental and control groups were included in these analyses. Interestingly, an exploratory hierarchical regression analysis revealed that trait procrastination added unique prediction to morning and afternoon subjective fatigue during Weeks 1 and 2 after controlling for the length of time slept and snoozed. Tables 18 and 19 display beta-weights and changes in  $R^2$  for these analyses. Trait procrastination accounted for an additional 11% of the variance in subjective morning fatigue during Week 1 and 5% during Week 2. Similarly, trait procrastination accounted for an additional 3% of the variance in subjective afternoon fatigue during Week 1 and 6% during Week 2.

Further hierarchical multiple regression analyses were conducted to assess the variance accounted for in both morning and afternoon subjective fatigue by procrastination above what might be predicted by other related trait variables, including

Table 18

Trait Procrastination as the Predictor of Subjective Morning Fatigue

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.04*	1, 108	-.19*
	Minutes Slept			
	Step 2	.00	2, 107	.03
	Snooze Time			
	Step 3	.11**	3, 106	.35**
	Procrastination			
	Total $R^2$	.15**		
2	Step 1	.07**	1, 108	-.26**
	Minutes Slept			
	Step 2	.00	2, 107	-.04
	Snooze Time			
	Step 3	.05*	3, 106	.24*
	Procrastination			
	Total $R^2$	.12*		
3	Step 1	.11**	1, 108	-.33**
	Minutes Slept			
	Step 2	.01	2, 107	-.11
	Snooze Time			
	Step 3	.03	3, 106	.18
	Procrastination			
	Total $R^2$	.13*		

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*Note.* N=110.

\*  $p < .05$ . \*\* $p < .01$

Table 19

Trait Procrastination as the Predictor of Subjective Afternoon Fatigue

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.14**	1, 108	-.37**
	Minutes Slept			
	Step 2	.01	2, 107	.11
	Snooze Time			
	Step 3	.03*	3, 106	.19*
	Procrastination			
	Total $R^2$	.18*		
2	Step 1	.11**	1, 108	-.33**
	Minutes Slept			
	Step 2	.03	2, 107	.18
	Snooze Time			
	Step 3	.06	3, 106	.26**
	Procrastination			
	Total $R^2$	.20**		
3	Step 1	.15**	1, 108	-.39**
	Minutes Slept			
	Step 2	.04*	2, 107	-.24*
	Snooze Time			
	Step 3	.02	3, 106	.16
	Procrastination			
	Total $R^2$	.21*		

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Note. N=110.

\*  $p < .05$ . \*\* $p < .01$

Table 20

Trait Procrastination as the Predictor of Subjective Morning Fatigue after Controlling for Related Trait Variables

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.04*	1, 108	-.19*
	Minutes Slept			
	Step 2	.24**	3, 106	
	Trait variables <sup>a</sup>			
	Step 3	.03*	4, 105	.20*
	Procrastination			
	Total $R^2$	.31**		
2	Step 1	.07**	1, 108	-.20*
	Minutes Slept			
	Step 2	.22**	3, 106	
	Trait variables <sup>a</sup>			
	Step 3	.00	4, 105	.06
	Procrastination			
	Total $R^2$	.29**		
3	Step 1	.10**	1, 108	-.33**
	Minutes Slept			
	Step 2	.13**	3, 106	
	Trait variables <sup>a</sup>			
	Step 3	.00	4, 105	.03
	Procrastination			
	Total $R^2$	.24**		

*Note.* N=110. <sup>a</sup>Trait variables include anxiety and neuroticism.

\*  $p < .05$ . \*\* $p < .01$

Table 21

Trait Procrastination as the Predictor of Subjective Afternoon Fatigue after Controlling for Related Trait Variables

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.14**	1, 108	-.37**
	Minutes Slept			
	Step 2	.12**	3, 106	
	Trait variables <sup>a</sup>			
	Step 3	.01	4, 105	.09
	Procrastination			
	Total $R^2$	.26*		
2	Step 1	.11**	1, 108	-.33*
	Minutes Slept			
	Step 2	.21**	3, 106	
	Trait variables <sup>a</sup>			
	Step 3	.00	4, 105	.07
	Procrastination			
	Total $R^2$	.32**		
3	Step 1	.15**	1, 108	-.39**
	Minutes Slept			
	Step 2	.15**	3, 106	
	Trait variables <sup>a</sup>			
	Step 3	.00	4, 105	-.01
	Procrastination			
	Total $R^2$	.30**		

Note. N=110. <sup>a</sup>Trait variables include anxiety and neuroticism.

\*  $p < .05$ . \*\* $p < .01$

anxiety and neuroticism. Sleep time was entered in Step 1, the two trait variables were entered in 2, and trait procrastination was entered in Step 3. Tables 20 and 21 display beta-weights and changes in  $R^2$  for the analyses conducted regarding morning fatigue and afternoon fatigue, respectively. In all analyses, neuroticism and anxiety predicted a significant amount of variance in subjective fatigue above and beyond that predicted by the amount of time slept. However, trait procrastination only accounted for a significant amount of incremental variance beyond that in morning subjective fatigue during Week 1 (3%). Taken together, these results suggest that the relationship between trait procrastination and state fatigue is driven by the relationship between trait procrastination and other trait variables, and that the relationship between trait procrastination and fatigue is weak at the state-level.

### *Summary*

To summarize, trait procrastination was a significant predictor of behavioral procrastination as indicated by snooze time, and this relationship was stronger than the relationship between trait procrastination and self-reported snooze time. Trait procrastination was also a significant predictor of state subjective fatigue, both in the mornings and afternoons. However, behavioral procrastination did not predict state fatigue as expected and there were no significant differences in state fatigue across the three weeks of the study. The smallest statistically significant result in the current study had an associated effect size of  $d = .43$ . A post-hoc power analysis indicates that the power associated with this effect size was .93. Recall that the *a priori* hypothesized effect size for differences in fatigue scores across the week had an absolute value of  $d = .40$ , which has an associated power level of .88. This power level is relatively strong,

suggesting that an existing difference in fatigue scores with an associated effect size of  $d = .40$  or greater would have been detected. Retrospective self-reports of self-regulation activities suggest a decrease in several self-regulatory activities during Week 2, but an increase in one self-regulatory activity during this Week. But these findings must be interpreted with caution because retrospective reports of other activities did not align with reports obtained from daily measures. As expected, positive and negative trait affect significantly predicted subjective morning fatigue during all three weeks. Finally, trait procrastination did not account for a significant amount of variance in subjective fatigue after controlling for neuroticism and anxiety.



## **CHAPTER 4**

### **DISCUSSION**

This study was conducted to explore the relationships between procrastination, self-regulation, and fatigue using a longitudinal, within-subjects design and a control group to assess the amount of time participants spend putting off getting out of bed in the morning and related outcomes. Recent research on procrastination has suggested that procrastination represents a self-regulatory failure (Steel, 2007) or a lack of metacognitive strategies (Wolters, 2003). However, research has yet to explore the ways in which self-regulation may fail during procrastination. One possibility is that self-regulatory processes are absent when procrastination occurs; another is that these processes are in-use but are misguided. Because previous research has found that the use of self-regulation results in higher levels of fatigue (Muraven et al., 1998), and that procrastination is positively related to fatigue (Gropel & Steel, 2008), I proposed that self-regulation is the mechanism underlying the relationship between procrastination and fatigue.

Several noteworthy findings arise from the present study. First, as expected, trait procrastination accounted for a significant amount of variance in the amount of time spent delaying getting out of bed, suggesting that those who report higher levels of trait procrastination also demonstrate longer periods of behavior delay. However, this relationship was not present when global, self-reported behavior delay was assessed, but was only detected using daily measures of self-reported behavior through ESM. Second, I expected that if procrastination involves the misuse of self-regulatory processes, greater levels of fatigue would be reported following periods of longer behavior delay as

opposed to shorter periods. Although participants in the experimental group decreased the amount of time spent procrastinating getting out of bed during Week 2, subjective morning fatigue did not decrease. Retrospective reports of self-regulatory activities provided inconclusive results regarding the mental processes in which participants engaged while procrastinating due to: a) the decrease of some self-regulatory processes and increase in others during Week 2, and b) the lack of correspondence between the retrospective reports of other activities (e.g., being late to or missing scheduled activities) and daily reports of the same activities. Finally, trait variables such as positive affect, negative affect, and trait procrastination predicted a significant amount of variance in subjective morning fatigue; however, that variance accounted for by trait procrastination decreased substantially when other trait variables, which have been shown to predict subjective fatigue, were included. Methodological, theoretical, and practical implications are discussed below, as well as future directions and limitations.

### *Methodological Implications*

Experience sampling methodology was utilized to assess behavioral procrastination multiple times over a three-week period. This methodology was implemented to allow for aggregation, similar to the way in which self-report measures consist of multiple items which assess a given construct. Multiple measures of a self-reported behavior were obtained and averaged to assess general behavioral tendencies. The present study demonstrated a significant relationship between trait procrastination and daily self-reported behavioral procrastination that was not found between trait procrastination and global self-reported behavioral procrastination. These findings suggest that aggregation of multiple self-reported behaviors over a period of time

provides a different indication of behavioral procrastination than global self-reports regarding behavior. Moreover, the stronger relationship between repeatedly-measured behavioral procrastination and self-reported trait procrastination aligns with theoretical expectations that someone who reports greater global procrastination tendencies would also demonstrate greater behavior delay. In contrast, the nonsignificant relationship between trait procrastination and self-reports of behavior does not follow these theoretical expectations. As a result, these findings indicate that repeated measures of a self-reported behavior provide a different and likely more accurate measure of that behavior than individuals are able to report through global self-report measures.

To date, only one study has employed ESM in the assessment of the affective correlates of procrastination (Pychyl, Lee et al., 2000). However, ESM was used to obtain information regarding the activities in which participants were engaging in during several days before an academic deadline, and participants only reported procrastinating during a small portion of the assessed time-points. In light of the findings from the present study, it is recommended that future researchers interested in behavior delay should utilize ESM in order to obtain more accurate measures of procrastination behavior.

### *Theoretical Implications*

The primary hypotheses in the current study was that, due to the misuse of self-regulatory resources during procrastination, and the fact that self-regulatory processes lead to fatigue (Muraven et al., 1998), longer periods of behavior delay would lead to greater fatigue. However, reports of subjective fatigue did not fluctuate in accordance with the length of time spent procrastinating getting out of bed. These findings have

theoretical implications regarding the relationship of procrastination with self-regulation and the relationship of procrastination with fatigue, each of which is discussed in turn below.

*Relationship between procrastination and self-regulation.* Given that both behavioral procrastination and self-reported engagement in several self-regulatory processes decreased during Week 2, it may be that procrastination and self-regulation are related, such that when procrastination decreases, so does the use of self-regulatory processes, and vice versa. These findings would suggest that misguided self-regulation is involved in behavioral procrastination. However, the lack of change in fatigue scores would suggest that, in this particular case, the misuse of self-regulatory strategies case does not lead to fatigue.

One possible reason why changes in fatigue were not detected could be that the self-regulatory processes engaged during procrastination are more automatized than in other settings, requiring fewer cognitive resources such that feelings of fatigue would not be affected. Although much of the research on self-regulation suggests that it is a controlled, resource-depleting process (e.g., R. Kanfer & Ackerman, 1989; Muraven & Baumeister, 2000; Muraven et al., 1998), DeShon, Brown, and Greenis (1996) reported that self-regulation may not necessarily be a controlled process all the time. The authors conducted a study using simple tasks to assess whether self-regulation pertaining to the primary task (tracking) requires attentional resources which interfere with the secondary task (letter memorization). While self-regulation was engaged through goal-setting on the primary task, it did not interfere with performance on the secondary task. These findings indicate that self-regulation may not always deplete cognitive resources and lead

to fatigue. When applied to the current study, it may be that the changes in plans and goals that occur when delaying getting out of bed are akin to “simple” tasks which do not require controlled cognition.

That participants were able to retrospectively report engaging in various self-regulatory processes seems to indicate that they were aware of these thoughts and processes, suggesting that they were conscious and controlled. However, further assessment of the accuracy of participant recall in reporting these self-regulation activities called into question whether participants were able to accurately remember and report the behaviors in which they engaged each morning. Reports regarding mental processes over the three-week period may have been more reflective of participants’ intent to show understanding of study instructions rather than accurate recall of plan and goal changing each morning. Retrospective self-reports of self-regulatory processes, then, may be inaccurate, which is, as Mischel (1977) suggested, one of the troubles with self-report measures.

If participants were not able to accurately report the engagement in self-regulatory processes each morning, the explanation that procrastination represents a lack of self-regulatory processes should be explored. This explanation suggests that differences in fatigue were not detected because procrastination represents an absence of self-regulatory processes rather than the presence of misguided self-regulatory processes. If self-regulatory processes are not engaged during procrastination, differences in fatigue that result from engagement in self-regulation would not be expected directly following behavioral procrastination. From this explanation, it follows that the negative correlation

between procrastination and self-regulation at the trait level reflects a lack of self-regulatory strategies for those high in trait procrastination.

As I cannot offer conclusive evidence for the nature of the relationship between procrastination and self-regulation, three directions for future research are offered. First, future researchers should directly assess self-regulatory processes that may or may not occur during behavioral procrastination, perhaps through think-aloud protocols or more extensive questioning through ESM. Second, future investigators should explore the inconclusive results offered by Muraven et al. (1999) regarding self-regulation as a muscle that might increase resistance to fatigue over time. If that is the case, individuals who procrastinate on a regular basis might employ self-regulatory processes frequently, but not feel fatigued from them as often as someone who does not procrastinate. Finally, research by Tomarken and Kirschenbaum (1982) suggests that differential self-monitoring may occur, in which individuals monitor positively valued behaviors less frequently than negatively valued behaviors. It may be that behavior delay in the present study was positively valued at the time of its occurrence (perhaps due to engaging in another, more pleasant activity, such as sleeping-in), and, as a result, individuals were less likely to engage in self-regulation. Future researchers might explore whether the value placed in the behavior which is being delayed plays a role in engagement of self-regulatory activities.

*Relationship between procrastination and fatigue.* Previous research has suggested a relationship between procrastination and fatigue at the trait level (e.g., Gropel & Steel, 2008), a finding that was replicated in the current study. This study also explored the relationship between procrastination and fatigue at the state level, but no

significant findings were revealed. Similarly, previous research by Pychyl et al. (2000) which assessed several instances of behavior delay, also did not find a significant relationship between state procrastination and state positive or negative affect. This lack of relationship was proposed to be due to the instability of very few behavioral measures. However, the current study measured a behavioral indicator of procrastination repeatedly over a three-week period, and this measure was also not significantly related to state subjective fatigue. Taken together, these findings suggest that despite the fact that individuals who are high in trait procrastination report wishing to reduce the tendency to delay (Solomon & Rothblum, 1984), and that these individuals do delay behavior more than others who are low in trait procrastination, state variables, such as fatigue and affect, do not seem to vary as a function of behavioral procrastination. Findings from the present study also provide weak support for a relationship between trait procrastination and state fatigue, as trait procrastination was only a significant predictor of morning subjective fatigue during Week 1 after accounting for other trait variables that have been shown to predict subjective fatigue. Taken together, these results indicate that the relationship between procrastination and fatigue operates more strongly at the trait level than at the state level.

### *Practical Implications*

In addition to these methodological and theoretical implications, several practical implications arise from the present study. Trait procrastination contributed unique prediction above and beyond that of amount of time slept to the prediction of the amount of time spent delaying getting out of bed in the morning. The inverse of this relationship also holds true, such that the amount of time spent delaying getting out of bed in the

morning adds unique prediction to trait procrastination. As a result, knowing on average how long a person spends snoozing each morning will aid in the prediction of his/her level of trait procrastination. This relationship may prove useful for individuals who are privy to the sleeping and waking habits of other individuals (e.g., college students and their roommates, traveling teams), in that those who do not prefer to delay tasks until close to the deadline may be able to choose to work with individuals who spend less time snoozing than others.

### *Limitations*

Several limitations should be mentioned in regard to the present study. First, the inclusion criteria limited participants to individuals who use an alarm to awaken each morning and press the snooze button on their alarms at least once per week-day morning. It is possible that some individuals do not wake up using an alarm, but do delay getting out of bed after first waking. These individuals were not assessed in the current study.

Second, the sample consisted solely of undergraduate students. The inclusion criterion of using an alarm to wake up each week-day morning was implemented in order to provide a sample that better modeled a sample of working adults. However, participants engaged in tasks and endeavors specific to being a student. Possible patterns of delaying awakening for school-related tasks may not be the same for individuals in a working environment who engage in different daily tasks.

Finally, despite the fact that many participants put off getting out of bed, the task of getting up each morning was one that all participants completed. No participants reported that they did not get out of bed on any day assessed in the present study. However, there are other tasks which participants may procrastinate that they do not



complete, such as studying for an exam or going to the doctor. It is possible that tasks which people intend to do but do not ever complete are different than tasks that people put off but eventually complete.

Appendix A  
General Snooze Function Usage Questionnaire

1. On an average morning, how many times do you press the snooze button on your alarm clock?
2. On an average morning, how long do you continue to sleep after your alarm goes off?
3. At approximately what time do you set your alarm on days that you have class?
4. Do you set your alarm on weekends?

*If you do not set your alarm on weekends, please go to item 6. Otherwise, please continue to item 5.*

5. At approximately what time do you set your alarm on weekends?
6. Do you have one or more roommate(s)?

*If you do not have one or more roommate(s), please go to the next page. Otherwise, please continue to items 7 and 8.*

7. Does your alarm clock wake your roommate(s) up in the mornings?
8. Do you think your roommate(s) is/are affected by your snooze button usage?

Appendix B  
Adult Inventory of Procrastination

1. I pay bills on time.
2. I am prompt and on time for my engagements (e.g., classes, appointments, activities).
3. I lay out my clothes the night before I have an engagement so I won't be late.
4. I find myself running later than I would like to be.
5. I don't get things done on time.
6. If someone were to teach a course on how to get things done on time, I would attend.
7. My friends and family think I wait until the last minute.
8. I get important things done with time to spare.
9. I am not very good at meeting deadlines.
10. I find myself running out of time.
11. I schedule doctor's appointments when I am supposed to without delay.
12. I am more punctual than most people I know.
13. I do routine maintenance on things I own (e.g., changing the car's oil) as often as I should.
14. When I have to be somewhere at a certain time, my friends expect me to run a bit late.
15. Putting things off until the last minute has cost me money in the past year.

Appendix C  
Achievement Goal Orientation Questionnaire

1. It is important for me to do better than other students.
2. Sometimes I am afraid that I may not understand the content of my classes as thoroughly as I would like.
3. I just want to avoid doing poorly in my classes.
4. It is important for me to understand the content of my courses as thoroughly as possible.
5. It is important for me to do well compared to others in college.
6. I am often concerned that I may not learn all there is to learn in my classes.
7. My fear of performing poorly in my classes is often what motivates me.
8. I desire to completely master the material presented in my classes.
9. I worry that I may not learn all that I possibly could in college.
10. My goal in my classes is to avoid performing poorly.
11. My goal in college is to get a better grade-point-average (GPA) than most of the other students.
12. I want to learn as much as possible from my classes in college.

## Appendix D

### Chalder's Fatigue Scale

1. I have problems with tiredness.
2. I feel a need to rest more.
3. I feel sleepy or drowsy.
4. I have problems starting things.
5. I lack energy.
6. My muscles feel weak.
7. I feel weak in general.
8. I have difficulty concentrating.
9. I have problems thinking clearly.
10. I find myself misspeaking.
11. I have trouble remembering things.

## Appendix E

### Karolinska Sleep Questionnaire

1. I have difficulty falling asleep.
2. I experience disturbed sleep.
3. I awaken repeatedly throughout the night.
4. I awaken before I intend to.

## Appendix F

### Morningness-Eveningness Questionnaire

1. Considering only your own “feeling best” rhythm, at what time would you get up if you were entirely free to plan your day? (Please round to the nearest hour.)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
AM												PM				Midnight							

2. Considering only your own “feeling best” rhythm, at what time would you go to bed if you were entirely free to plan your day? (Please round to the nearest hour.)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
AM												PM				Midnight							

3. If there is a specific time at which you have to get up in the morning, to what extent are you dependent on being woken up by an alarm clock?

- ☐ Not at all dependent
- ☐ Slightly dependent
- ☐ Fairly dependent
- ☐ Very dependent

4. Assuming adequate environmental conditions (e.g., normal room temperature), how easy do you find getting up in the morning?

- ☐ Not at all easy
- ☐ Not very easy
- ☐ Fairly easy
- ☐ Very easy

5. How alert do you feel during the first half hour after having woken in the mornings?

- ☐ Not at all alert
- ☐ Slightly alert
- ☐ Fairly alert
- ☐ Very alert

6. How is your appetite during the first half hour after having woken in the mornings?

- ☐ Not at all hungry
- ☐ Slightly hungry
- ☐ Fairly hungry
- ☐ Very hungry

7. During the first half hour after having woken in the mornings, how tired do you feel?

- ☐ Very tired
- ☐ Fairly tired
- ☐ Fairly refreshed
- ☐ Very refreshed

8. When you have no commitments the next day, at what time do you go to bed compared to your usual bed time?

- ☐ Seldom or never later
- ☐ Less than one hour later
- ☐ 1-2 hours later
- ☐ More than 2 hours later

9. You have decided to engage in some physical exercise with a friend. Your friend suggests that you do this one hour twice a week and the best time for her is between 7am and 8am. Bearing in mind nothing else but your own “feeling best” rhythm, how do you think you would perform?

- ☐ Would be on good form
- ☐ Would be on reasonable form
- ☐ Would find it difficult
- ☐ Would find it very difficult

10. At what time in the evening do you feel tired and, as a result, in need of sleep?  
(Please round to the nearest hour.)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
AM											PM					Midnight							



11. You wish to be at your best performance for a test which you know is going to be mentally exhausting and lasting for two hours. You are entirely free to plan your day. Considering only your own “feeling best” rhythm, which ONE of the four testing times would you choose?

- ☐ 8:00am – 10:00am
- ☐ 11:00am – 1:00pm
- ☐ 3:00pm – 5:00pm
- ☐ 7:00pm – 9:00pm

12. If you went to bed at 11pm, at what level of tiredness would you be?

- ☐ Not at all tired
- ☐ A little tired
- ☐ Fairly tired
- ☐ Very tired

13. For some reason you have gone to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which ONE of the following events are you most likely to experience?

- ☐ Will wake up at the usual time and will NOT fall back asleep
- ☐ Will wake up at the usual time and will doze thereafter
- ☐ Will wake up at the usual time but will fall asleep again
- ☐ Will NOT wake up until later than usual

14. One night you have to remain awake between 4am and 6am in order to carry out a night watch. You have no commitments the next day. Which ONE of the following alternatives would suit you best?

- ☐ Would NOT go to bed until watch was over
- ☐ Would take a nap before and sleep after
- ☐ Would sleep before and nap after
- ☐ Would ONLY sleep before the watch

15. You have to do two hours of hard physical work. You are entirely free to plan your day. Considering only your own “feeling best” rhythm, which ONE of the following times would you choose?

- ☐ 8:00am – 10:00am
- ☐ 11:00am – 1:00pm
- ☐ 3:00pm – 5:00pm
- ☐ 7:00pm – 9:00pm

16. You have decided to engage in hard physical exercise with a friend. Your friend suggests that you do this one hour twice a week and the best time for her is between 10pm and 11pm. Bearing in mind nothing else but your own “feeling best” rhythm, how do you think you would perform?

- ☐ Would be on good form
- ☐ Would be on reasonable form
- ☐ Would find it difficult
- ☐ Would find it very difficult

17. Suppose that you can choose your own work hours. Assume that you worked a five hour day (including breaks) and that your job was interesting and paid by results. Which five consecutive hours would you select? Please check five boxes.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
AM											PM						Midnight						

18. At what time of day to you think you reach your “feeling best” peak? Please check one box and round to the nearest hour.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
AM											PM						Midnight						

19. One hears about “morning” and “evening” types of people. Which ONE of these types do you consider yourself to be?

- ☐ Definitely a “morning” type
- ☐ Rather more a “morning” than an “evening” type
- ☐ Rather more an “evening” than a “morning” type
- ☐ Definitely an “evening” type

## Appendix G

### Münich Chronotype Questionnaire

1. Do you have a regular work and/or school schedule? If yes, how many days per week?

Questions 2-8: The following questions pertain to work and/or school days.

2. I go to bed at \_\_\_\_\_ o'clock \_\_\_\_am \_\_\_\_pm
3. I actually get ready to fall asleep at \_\_\_\_\_ o'clock \_\_\_\_am \_\_\_\_pm.
4. I need \_\_\_\_\_ minutes to fall asleep.
5. I wake up at \_\_\_\_\_ o'clock \_\_\_\_am \_\_\_\_pm.
6. After \_\_\_\_\_ minutes, I get up.
7. Do you use an alarm clock to wake up on work and/or school days?
8. If yes, do you regularly wake up before the alarm first rings?

Questions 9-15: The following questions pertain to free days (e.g., weekends).

9. I go to bed at \_\_\_\_\_ o'clock \_\_\_\_am \_\_\_\_pm.
10. I actually get ready to fall asleep at \_\_\_\_\_ o'clock \_\_\_\_am \_\_\_\_pm.
11. I need \_\_\_\_\_ minutes to fall asleep.
12. I wake up at \_\_\_\_\_ o'clock \_\_\_\_am \_\_\_\_pm.
13. After \_\_\_\_\_ minutes, I get up.
14. Is the wake-up time you have just given due to the use of an alarm clock even on free days?
15. Is there a reason why you cannot freely choose your sleep times on free days?

Questions 16-17: The following questions pertain to the amount of time you spend in daylight.

16. How long do you spend outside (in daylight, without a roof above your head) on work and/or school days? Please give an average value for a typical day.
17. How long do you spend outside (in daylight, without a roof above your head) on free days? Please give an average value for a typical day.

## Appendix H

### Positive Affect and Negative Affect Scale

#### Positive Affect

1. interested
2. excited
3. strong
4. enthusiastic
5. proud
6. inspired
7. determined
8. attentive
9. active

#### Negative Affect

1. distressed
2. upset
3. guilty
4. scared
5. hostile
6. jittery
7. nervous
8. ashamed
9. afraid
10. irritable

Appendix I  
IPIP Personality Scales

Conscientiousness

1. I am always prepared.
2. I make a mess of things.
3. I am exacting in my work.
4. I like order.
5. I follow a schedule.
6. I leave my belongings around.
7. I avoid my duties.
8. I pay attention to details.
9. I often forget to put things back in their proper place.
10. I get chores done right away.

Impulse Control

1. I keep my emotions under control.
2. I let others finish what they are saying.
3. I react intensely.
4. I talk even when I know I shouldn't.
5. I often make a fuss.
6. I shoot my mouth off.
7. I am easily excited.
8. I blurt out whatever comes into my mind.
9. I barge in on conversations.

### Extraversion

1. I am the life of the party.
2. I have little to say.
3. I feel comfortable around people.
4. I start conversations.
5. I keep in the background.
6. I talk a lot to different people at parties.
7. I don't like to draw attention to myself.
8. I don't talk a lot.
9. I don't mind being the center of attention.
10. I am quiet around strangers.

### Neuroticism

1. I often feel blue.
2. I have frequent mood swings.
3. I feel comfortable with myself.
4. I am often down in the dumps.
5. I am very pleased with myself.
6. I rarely get irritated.
7. I seldom feel blue.
8. I dislike myself.
9. I am not easily bothered by things.
10. I panic easily.

### Self-Regulation/Self-Control

1. I have no trouble eating healthy foods.
2. I do not exercise on a regular basis.
3. I forego things that are bad for me in the long run even if they make me feel good in the short run.
4. I am not very good at getting things done.
5. I can always say “enough is enough.”
6. I give in to my urges.
7. I do my tasks only just before they need to get done.
8. I can stay on a diet.
9. I let myself be taken over by urges to spend or eat too much.
10. I can't resist eating cookies or candy if they are around.
11. I am a highly disciplined person.

### Resourcefulness

1. I can handle complex problems.
2. I can't make up my mind.
3. I am good at many things.
4. I am easily discouraged.
5. I complete tasks successfully.
6. I wait for others to lead the way.
7. I formulate ideas clearly.
8. I am easily intimidated.
9. I face problems directly.



### Perfectionism

1. I continue until everything is perfect.
2. I want every detail taken care of.
3. I am not bothered by messy people.
4. I want things to proceed according to plan.
5. I demand perfection in others.
6. I am not bothered by disorder.
7. I expect dedicated work from others.
8. I want everything to be “just right.”
9. I keep a sharp eye on others’ work.

### Curiosity

1. I find the world a very interesting place.
2. I am never bored.
3. I am not all that curious about the world.
4. I am always busy with something interesting.
5. I can find something of interest in any situation.
6. I think that my life is extremely interesting.
7. I find it difficult to entertain myself.
8. I am excited by many different activities.
9. I have few interests.
10. I love to hear about other countries and other cultures.

## Anxiety

1. I am afraid that I will do the wrong thing.
2. I feel threatened easily.
3. I don't worry about things that have already happened.
4. I feel guilty when I say "no."
5. I spend time thinking about past mistakes.
6. I worry about things.
7. I feel crushed by setbacks.
8. I am easily hurt.
9. I don't let others discourage me.

Appendix J  
Morning Questionnaire

Weeks 1 & 3

1. At what time was your alarm set this morning?
2. At what time did you turn your alarm off?
3. How many times did you press the snooze button?
4. Indicate the time at which you awoke this morning. That is, the first time at which you were awake and did not go back to sleep.
5. At what time did you get out of bed this morning?
6. What time did you fall asleep last night/this morning?
7. Did you use multiple alarms to wake you up this morning?
8. If yes, how many alarms did you use?

Week 2 (Experimental Condition Only)

1. At what time was your alarm set this morning?
2. At what time did you turn your alarm off?
3. Indicate the time at which you awoke this morning. That is, the first time at which you were awake and did not go back to sleep.
4. At what time did you get out of bed this morning?
5. What time did you fall asleep last night/this morning?
6. Did you use any alarm in addition to the study alarm to wake you up?
7. If yes, at what time was that alarm set?

Appendix K  
Afternoon Questionnaire

1. At what time is/was your first scheduled activity today?
2. Did you engage in any activity before getting out of bed this morning? (e.g., watching TV, checking email, talking on the phone)
3. If you did engage in an activity before getting out of bed this morning, approximately how long?
4. Did something or someone else, other than the alarm(s) that you set, wake you up this morning?

Appendix L  
Evening Questionnaire

1. Did you take a nap today?
2. If yes, how long was your nap?
3. If yes, at what time did your nap start?
4. At what time is your alarm set tomorrow morning?

## Appendix M

### Final Questionnaire

Questions 1 through 10 were asked of experimental participants regarding Weeks 1 and 3, and of control participants regarding all weeks of the study. Questions pertaining to Week 2 were altered for the experimental group to read “after turning off the study alarm” in place of “after pressing the snooze button.” Questions 11 and 12 were asked of both groups regarding future behavior expectations.

1. After pressing the snooze button, I went back to sleep.
2. After pressing the snooze button, I dozed in and out of sleep.
3. After pressing the snooze button, I lay awake thinking of things I needed to do.
4. After pressing the snooze button, I engaged in an activity (e.g., reading, watching TV, checking e-mail).
5. I wished I did not put off getting out of bed in the morning.
6. After pressing the snooze button, I lay in bed and changed my plans for that morning (e.g., skipped breakfast so I could sleep a little longer).
7. Putting off getting out of bed in the morning made me late for my first scheduled activity of the day.
8. I found it difficult to get up in the morning.
9. I planned to do more things in the morning before my first scheduled activity than I actually did.
10. Putting off getting out of bed in the morning bothered people who are close to me (e.g., friends, family, roommates).
11. Would you choose to use an alarm without a snooze button in the future?
12. Do you think you will change your alarm and snoozing habits after participating in this study?

## Appendix N

### Exploration of secondary hypotheses which pertain to relationships between trait variables

Hypothesis	Anticipated Effect Size	Results
5: Trait procrastination will be negatively related to mastery orientation.	$r = -.28$	$r = -.18$
6: Trait procrastination will be positively related to performance orientation.	$r = .27$	$r = -.09$
7: Sleep disturbance will be positively associated with trait fatigue.	$r = .60$	$r = .17$
9: Eveningness will be negatively associated with trait procrastination.	$r = -.35$	$r = -.32^{**}$
11: Trait procrastination will be positively associated with trait negative affect.	$r = .30$	$r = .29^{**}$
12: Trait procrastination will be negatively associated with trait positive affect.	$r = -.30$	$r = -.31^{**}$
13: Trait subjective fatigue will be positively associated with trait negative affect.	$r = .45$	$r = .52^{**}$
15: Trait subjective fatigue will be negatively associated with positive affect.	$r = -.45$	$r = -.36^{**}$

*Note.* N=110. <sup>a</sup>One-tailed test.

\*  $p < .05$ . \*\* $p < .01$

The majority of the hypotheses related to trait variables were supported in the present study. In addition, many of the correlations obtained in the current study were similar to the values that were anticipated. Each of the above hypotheses and results are discussed in turn below.

In order to test Hypothesis 5, scores on the performance and mastery axes of the achievement goal orientation questionnaire were averaged across approach and avoidance dimensions in order to obtain mean performance and mastery ratings. Hypothesis 5 was not supported, as the correlation between the mastery dimension and mean procrastination was not significant ( $r = -.18$ , ns). Similarly, support was not provided for Hypothesis 6, in that a nonsignificant correlation was found between the performance dimension and mean procrastination ( $r = -.09$ , ns). Taken together, these results suggest that procrastination may not be related to the performance and mastery dimensions of goal orientation when goal orientation is assessed through a broad topic such as overall college performance. However, the internal consistency of the collapsed scales for performance and mastery were relatively low ( $\alpha = .68$  and  $\alpha = .75$  respectively). Interestingly, procrastination was significantly and negatively related to the approach dimension of goal orientation ( $r = -.22$ ,  $p = .02$ ), but not the avoidance dimension ( $r = -.05$ , ns).

Hypothesis 7 was not supported, as there was a nonsignificant correlation between the CFS and KSQ. This finding suggests that trait subjective fatigue is not significantly related to global reports of sleep disturbance. A significant positive correlation was found between the AIP and MEQ ( $r = -.32$ ,  $p < .01$ ), suggesting that those who score higher in trait procrastination also report greater preferences towards eveningness.

Several hypotheses were supported with regards to positive and negative affect. Hypothesis 11 was supported in that a significant positive correlation was also found for the AIP and NA ( $r = .29$ ,  $p < .01$ ), suggesting that those who score higher in trait procrastination also report greater negative affect. In contrast, those who score higher in



trait procrastination also reported lower levels of positive affect, as the AIP and PA were negatively correlated ( $r = -.31, p < .01$ ). This provides support for Hypothesis 12.

Hypotheses 13 and 15 were supported by a positive correlation between the CFS and NA ( $r = .52, p < .01$ ) and a negative correlation with PA ( $r = -.36, p < .01$ ), respectively. These findings suggest that those who report greater overall subjective fatigue also report greater negative affect and less positive affect.

## Appendix O

### Exploratory hypotheses related to afternoon subjective fatigue and goal orientation

#### *Afternoon Fatigue*

A priori hypotheses were not posited regarding daily afternoon fatigue levels. Exploratory analyses similar to those conducted with subjective morning fatigue levels to explore state afternoon fatigue. These analyses include correlations, paired *t*-tests, and hierarchical regression analyses.

Similar to correlations computed with morning fatigue scores, correlations were computed between the KSQ, MEQ, and average Week 1 afternoon fatigue scores. Similar to results with morning subjective fatigue, afternoon subjective fatigue was moderately and negatively correlated with the MEQ ( $r = -.22, p < .05$ ). However, in contrast to subjective morning fatigue, subjective afternoon fatigue was not related to the KSQ. These results suggest that participants who reported greater preferences for eveningness also reported greater afternoon fatigue, but eveningness preferences were not related to global reports of sleep disturbance.

Paired *t*-tests were conducted to explore whether afternoon fatigue was different for experimental participants during Week 2 when they were instructed to use the study alarm and minimize snooze time. Similar to findings related to subjective morning fatigue, experimental participants did not report significantly different levels of afternoon fatigue during Week 2 compared to Week 1 or 3.

Finally, a hierarchical regression analysis was conducted to assess whether snooze time predicted afternoon fatigue after controlling for sleep time. Table O17 shows that sleep time predicted afternoon fatigue in Weeks 2 and 3, with snooze time only adding

unique prediction in Week 3. Taken together, these results suggest that afternoon fatigue reports were relatively similar to morning fatigue in that they exhibited a similar pattern of relationships with other variables.

#### *Goal Orientation.*

Hypotheses were proposed *a priori* with respect to trait procrastination and the performance-mastery axis of goal orientation, but hypotheses were not suggested regarding the ways in which snooze time might be related to these dimensions of goal orientation. Nonsignificant correlations were found between the amount of snooze time and performance or mastery goal orientation during all three weeks of the study for both the experimental and control groups. These findings are not surprising given the nonsignificant relationship between trait procrastination and these orientations in the current study. Point-biserial correlations were also conducted to assess whether goal orientation was related to whether or not participants with different orientation preferences would report more willingness to use a different alarm and/or change their future snoozing habits; however, no significant results were found.

Table O17

## Snooze Time as the Predictor of Subjective Afternoon Fatigue

Week	Predictor	$\Delta R^2$	<i>df</i>	$\beta$
1	Step 1	.14*	1, 108	-.30*
	Minutes Slept			
	Step 2	.01	2, 107	.12
	Snooze Time			
	Total $R^2$	.15*		
2	Step 1	.11*	1, 108	-.40*
	Minutes Slept			
	Step 2	.03	2, 107	-.18
	Snooze Time			
	Total $R^2$	.14*		
3	Step 1	.15**	1, 108	-.53**
	Minutes Slept			
	Step 2	.04	2, 107	-.24
	Snooze Time			
	Total $R^2$	.19**		

*Note.* N = 110.

\*  $p < .05$ . \*\* $p < .01$

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